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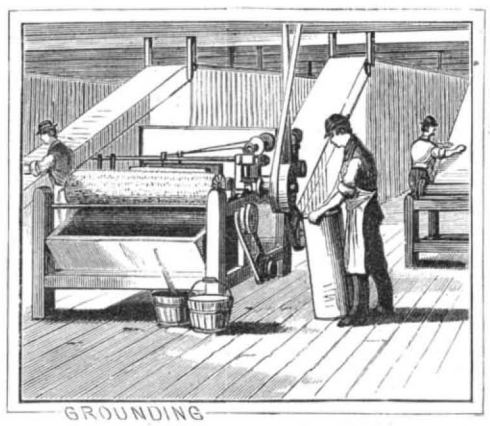

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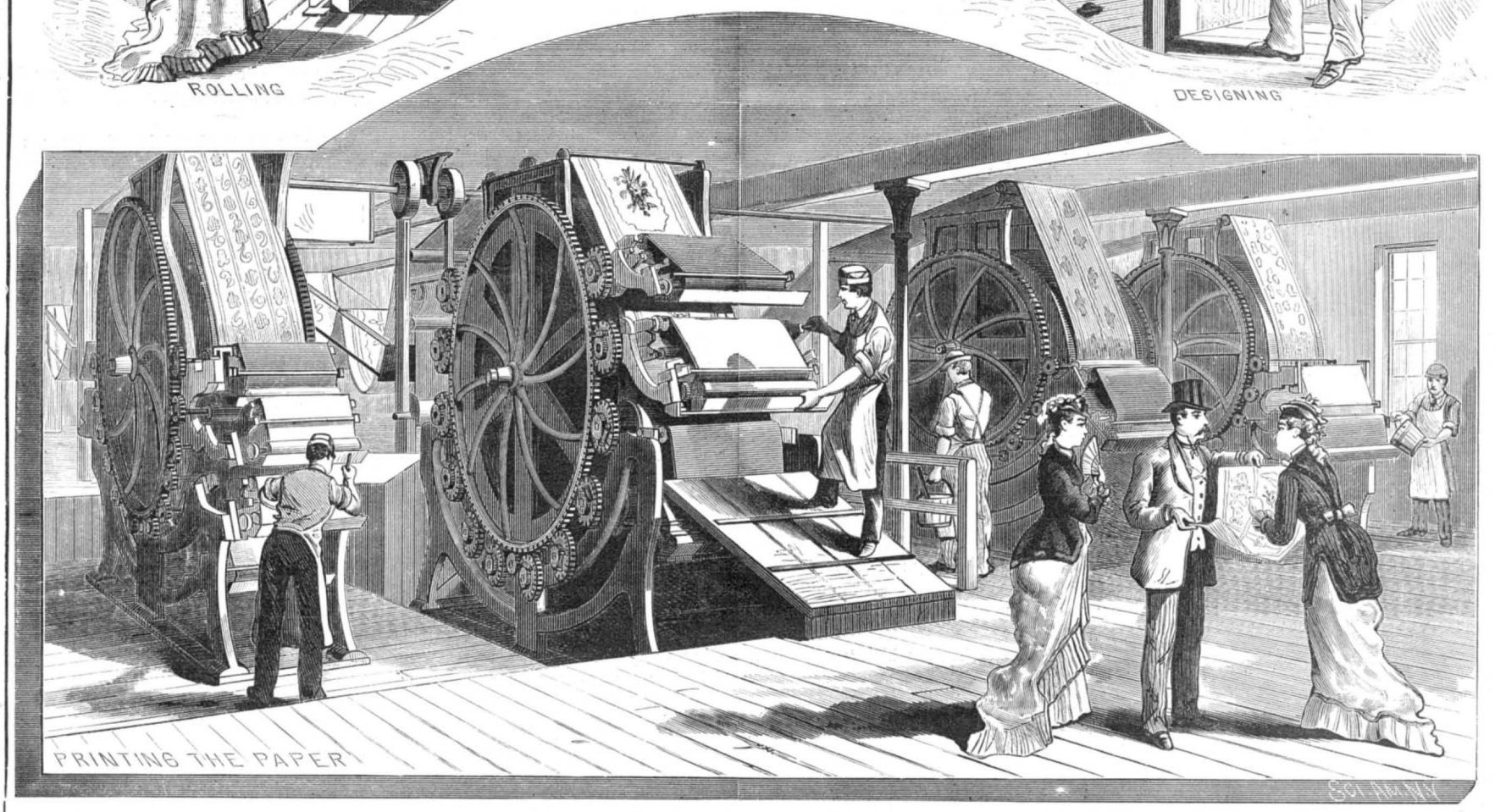

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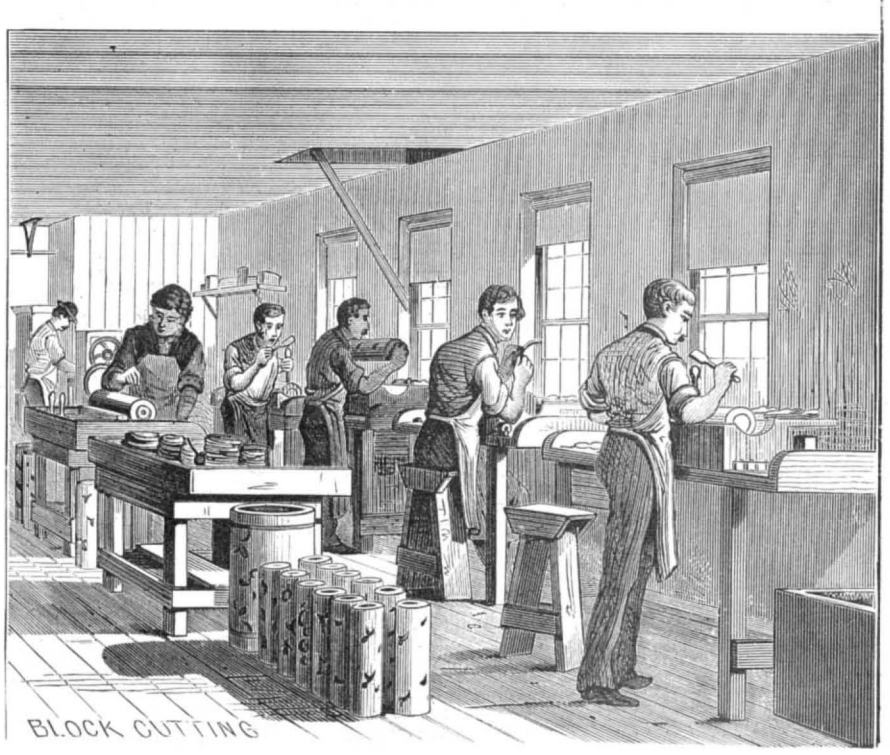

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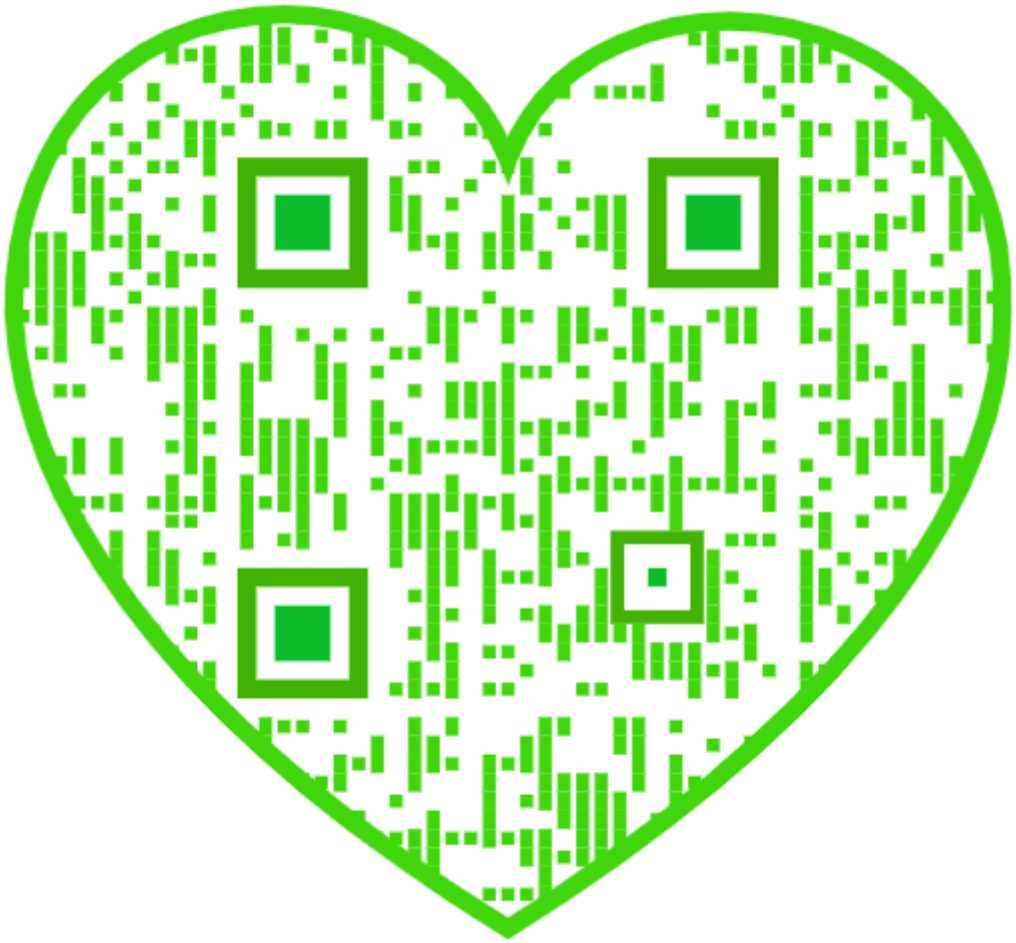

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MATTER AS A MODE OF MOTION.

It is a curious circumstance that while from the non-scientific point of view the unpardonable fault of modern science is its "materialistic tendency," the actual drift of scientific thought is toward eliminating from the scientific idea of matter everything which answers to the popular notion of it. Already science has permanently transferred to the domain of motion all those possibilities of sensation, such as light, heat, electricity, and so on, formerly defined as imponderable matter; and latterly the indications have been very clear that ponderable matter may sooner or later share the same fate.

This comes out strongly in the discussion awakened by Professor Crookes' discoveries touching the behavior of molecules in high vacua. As our readers are well aware, Professor Crookes claims to have demonstrated an ultra-gaseous or fourth state of matter, as unlike the other three recognized states of matter as they are unlike each other. In answer to a friendly challenge to make good his position, Professor Crookes has reviewed (in a letter to the Secretary of the Royal Society, to be found in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT) the accepted views as to the constitution of solids, liquids, and gases, and has added thereto a concise explanation of the ultra-gaseous state and his reasons for holding it worthy of a class by itself.

Stated with the utmost brevity, a solid is an aggregation of molecules held together by cohesion and oscillating about fixed centers. The movements of the molecules are large in comparison with their diameters, since the mass "must be able to bear a reduction of temperature of nearly 300° C. before the amplitude of the molecular excursion would vanish." What would result from the arrest of molecular movement and the actual contact of the molecules is beyond our conception, all we know of matter being based wholly upon our experience of molecular movements.

When the temperature of a solid is raised and the force of cohesion so far overcome that the molecules lose their fixity of position, the second or liquid state of matter obtains. A further raising of the temperature brings the liquid at last to a point at which cohesion ceases, the molecules fly apart freely, and the third or gaseous state begins. Under the restraining force of gravitation or the resistance of an inclosing vessel, the molecules of a gas fly about in every conceivable direction, with constant collisions with each other and with the vessel's sides. The gaseous state is thus preeminently one dependent on molecular collisions, the mean free path of the molecules, in other words, their flight between collisions, being small compared with the dimensions of the inclosing vessel.

The fourth state of matter, according to Professor Crookes, obtains when the gas has been so rarefied that the collisions of the molecules are few compared with the misses, the free path of the molecules being so long, on an average, that each molecule is allowed to obey its own motions or laws, without interference from collisions with other molecules or with the sides of the inclosing vessel. The same condition prevails when the molecules of a denser gas are so marshaled in their flight that their motion is rectilinear and no collisions occur. Between the third and fourth states there is no sharp line of demarkation, any more than there is between the solid and liquid states, or the liquid and gaseous states; they merge insensibly one into the other.

Thus starting from a possible, though in our present state undemonstrable, condition of matter, in which the molecules are motionless and in contact—a condition, we must remember, in which "matter" would in no way answer to the definition of matter as discovered by our senses—we pass on through stages of increasing molecular freedom and amplitude of motion, until we arrive at a stage of comparative molecular independence and rectilinear flight, limited in our experiments by the necessary walls of our vacuum apparatus. If we try to follow in imagination the free molecule in its flight into unlimited space, it loses all known properties of matter and becomes as if it were not. For what is a single free molecule in space? Is it solid, liquid, or gas?

Professor Crookes answers: "Solid it cannot be, because the idea of solidity involves certain properties which are absent in the isolated molecule. In fact, an isolated molecule is an inconceivable entity, whether we try, like Newton, to visualize it as a little hard spherical body, or, with Boscovitch or Faraday, to regard it as a center of force, or accept Sir William Thomson's vortex atom. But if the individual molecule is not solid, *a fortiori* it cannot be regarded as a liquid or a gas, for these states are even more due to intermolecular collisions than is the solid state. The individual molecules, therefore, must be classed in a distinct state or category."

Further on Professor Crookes takes up again the consideration of the molecule, and describes it as the only true *matter*. "What we call matter is nothing more than the effect upon our senses of the movements of molecule. The space covered by the motion of molecules [from which we derive our idea of continuous matter] has no more right to be called matter than the air traversed by a rifle bullet can be called lead. From this point of view, then, matter is but a mode of motion; at the absolute zero of temperature the intermolecular movement would stop, and, although something retaining the properties of inertia and weight would remain, *matter* as we know it would cease to exist"

Thus, whether we pursue our quest of the ultimate basis of matter atomward or massward, we lose matter as a reality the moment we eliminate molecular interaction; and molecular movement forms no part of the popular idea of matter.

EXPLOSIVES.

Were the question suddenly proposed to any intelligent person, "What is an explosive?" the chances that he would give a correct answer are indeed small. Our first and usual idea is that an explosive is something which will blow up, making a big noise and doing more or less damage. Generally it is some solid or liquid capable of burning with great rapidity and thus generating a large quantity of gas. Gunpowder is a familiar example; the niter furnishes oxygen to burn the sulphur and charcoal, most of the products being gaseous. Bunsen, who made some careful quantitative experiments upon the combustion of gunpowder, found that 1 gramme of sporting powder produced 193 c.c. of gas, while Linck obtained 218 c.c. of gas from 1 gramme of war powder, and as one gramme of powder will occupy less than 1 c.c. of space, the increase of volume is very considerable. But this is not all, for the temperature at the time of explosion is calculated to be about 3,000° C., and gases double their volume whenever the temperature is raised 273°.

Explosions are in but few cases due to the rapid combustion of solids or liquids, but more frequently they consist in the rapid combination of two gases, or of a vapor and a gas. When pure hydrogen and oxygen are mixed in proportion of two volumes of the former to one of the latter, a spark causes them to unite with explosive violence, although the resulting product, at 100° C., occupies but two-thirds as much space of the mixed gases, and at ordinary temperatures it occupies but $\frac{1}{2500}$ as much space. The rapidity with which a flame travels in such a mixture is not less than 100 feet per second. The temperature produced is very high, and at this temperature, of course, the gases occupy a very large space.

Rapid combustion of solids in a fine state of division may exhibit the usual phenomenon of an explosion, as has several times occurred in flouring mills, or wherever dust mixed with air has been ignited by a spark. The explosion of gasolene and benzine is of the same nature. The vapor is the substance in an extremely fine state of division and mixed with the air; as in the case of oxygen and hydrogen a union of the two takes place instantaneously throughout the mixture.

Explosives are not always combustible substances, and their explosion is not the result either directly or indirectly of their rapid combustion. A good example of this class of explosives is found in chloride of nitrogen. Neither of its constituents will unite directly with oxygen, but they are wedded to each other so slightly that each seems equally eager for divorce on the slightest provocation. It is the dissociation of this substance, which suddenly passes from the liquid to the gaseous form, that renders it a dangerous explosive. Many other nitrogen compounds behave in a similar manner; such, for example, as the iodide nitrogen, formed when iodine is washed with ammonia.

Then follow the nitro compounds, or nitrous ethers, familiar among which are nitro-cellulose, nitro-glucose, nitro-starch, and nitro-glycerine. These substances, which are so readily formed by treating cotton, glucose, starch, or glycerine with strong nitric acid, contain an atom of nitrogen united with two of oxygen. This nitro group is a mischievous partner, and is pretty sure to break up any stock company that he gets into as a member. He is not satisfied to walk out peacefully, but like Goliath pulls the whole fabric down about his ears. Although nitro-glycerine requires a high temperature to explode it, a very slight shock or jar will set up decomposition. Nitro-cellulose, or gun-cotton, on the other hand, burns quietly but rapidly. The former produces a powerful effect when exploded without confinement, as on the surface of a body; gun-cotton can be exploded on the open hand without inconvenience.

Another nitro compound of some interest as an explosive is picric acid, a trinitro-phenol, formed by treating carbolic acid with strong nitric acid. The nitro groups here, as in nitro-benzol, seem to possess an entirely different position, the result not being, as in nitro-cellulose, a nitrous ether. The potassium and some other salts of this acid possess explosive properties.

Finally we have a class of bodies known as *fulminates*. They have the same percentage composition as the harmless cyanates and cyanurates, with which they are said to be polymeric. They consist of a metal combined with carbon, oxygen, and nitrogen in the proportion of their atomic weights. Fulminating mercury was discovered by Howard in 1800. It is made by dissolving 1 part of mercury in 12 of nitric acid (sp. gr. 1·3), and when cold it is mixed with 11 parts of 85 per cent alcohol, and the mixture heated on a water bath. It must be removed from the fire as soon as it begins to show turbidity, then left to cool, decanted, and recrystallized from boiling water. It crystallizes in white silky needles. It detonates with great violence when forcibly struck, hence it is used in percussion caps, torpedoes, and the like. Ten grains of this substance produces 4 cubic inches of permanent gases, but at the high temperature of explosion occupy far more space. The explosion is so sudden as to be particularly dangerous when in large masses. Mixed with 30 per cent water it can be triturated on a marble slab with a wooden pestle, but when dry must be kept in small separate portions. One kilogramme (2·2 lb.) of mercury will make enough fulminate to fill 57,600 gun caps, but their preparation is not unattended with danger. Fulminating silver is made by the action of nitric acid and alcohol on nitrate of silver.

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A substitute for fulminating mercury is employed in the needle guns in Germany. It consists of a mixture of equal parts of chlorate of potassium and sulphide of antimony. As both of these substances are largely employed in medicine it is highly desirable they should not be combined in the same prescription. A mixture of sulphur and chlorate of potassium will also explode by friction or percussion. When a solution of sulphur in carbon disulphide is poured upon finely divided chlorate the mixture will often explode spontaneously when the solvent has evaporated, if not, the touch of a feather is sufficient to produce a violent detonation. Chlorate of potassium and red phosphorus form a safe and powerful mixture for ignition by percussion, known as Armstrong's mixture.

In addition to the above explosives there are many compounds known only in chemical laboratories, which, either from their danger, uncertainty, or danger of preparation have not been made public.

From the above we see that an explosive may be a solid, liquid, or gas, and its explosion may result either from its dissociation or combustion.

They may be divided according to their effects into slow and rapid, although these terms are only relative. Gunpowder burns so slowly as to be well adapted as propulsive for projectiles, while nitro-glycerine decomposes so rapidly as to be useful only for bursting and rending, and should have well reserved for it the name of "rend rock." Guncotton has been used especially in the compressed form, for artillery, and picrate powder was used in France as substitute for gunpowder.

CURIOUS CAPILLARY PHENOMENA.

When a drop of water falls on a surface which does not absorb it, it is well known that it assumes a special form—that of a plano-convex lens. If above such a drop of water there be suspended, by means of a thread having no twist in it, a fine needle, the point of the latter, being repelled by the edges or attracted by the center of the convexity, at length remains stationary at the latter spot. There is, then, on the surface of this convex drop a point where the forces of tension are in equilibrium. But the above mode of experimenting is too imperfect to allow a serious study of the phenomenon, since the tension of the convex surface has to overcome the weight of the needle in order to swerve it from the vertical. M. Coutance, says the *Revue Industrielle*, has suggested an ingenious method of surmounting the difficulty by making the needle stationary and rendering the drop movable. A small piece of glazed note-paper is floated on water, and on the surface of this is placed a large and very convex drop of water. The paper, thus freighted, moves about under the slightest influence. Pushed gently toward the fixed point, it begins to move as soon as the latter touches the edge of the drop, and the two elements always arrange themselves in such a way that the needle point occupies the center of the convexity; thus proving the existence of a center of equilibrium for the tensile forces of the liquid surface. By means of this ingenious method of experimenting, we are enabled to determine points of equilibrium in drops of liquid having most varied outlines, but of a convex surface. For instance, a curved liquid surface, having the outline of an isosceles triangle, will, when presented by its apex, so displace itself that the needle, on traversing it, stops exactly at the center of gravity.

One of the most curious means of showing the equilibrium of tensile forces in these variously shaped liquids with curved surfaces is this: Draw a helicoidal figure on glazed paper with a moistened pencil. This will represent the circumvolutions of the snail's shell. Now carefully fill in the figure with water so that its surface shall have a broadly convex form. Then push the attenuated apex of the figure toward the fixed needle. As soon as contact takes place, leave the whole to itself. Then, all at once, the paper will be seen to gyrate, and the needle will traverse the whole spiral and stop just before reaching the broad base of the latter.

Here, then, we have the forces of tension of liquid surfaces shown by a physical phenomenon. The use of glazed paper in these experiments is attended with some inconvenience, because it absorbs water. It is better, therefore, to use cork or wax. In all these movable convex surfaces, the point of the fixed needle always locates itself at the exact center of the figure. Suppose, for instance, a convex figure having the outlines of France be made on the surface of the paper or wax; when it is placed in contact with the needle point, the latter will fix itself in the center of the country, *i. e.*, at a spot which would correspond to a point a little to the east of Bourges. To determine the center of a country by means of capillarity might, at first sight, seem an impossibility; but, as will be seen, the question is capable of being scientifically resolved. As to the practical applications of phenomena like these, it would be as yet difficult to cite them: but it is certainly remarkable to see revealed to our eyes, by means of these experiments, those forces whose operation our intelligence alone is powerless to understand, and whose laws can now be studied, analyzed, and translated into algebraic language.

A QUICK TRIP FROM GALVESTON.—The quickest recorded passage from Galveston, Texas, to this port, was completed July 6, by the steamship Rio Grande. Her actual running time from Galveston bar to Upper Quarantine, New York harbor, was 5 days 19 hours 20 minutes; distance, as shown by the ship's log, 1,935 nautical miles

PANAMA HATS.

Now that the summer season is on us, it may not be uninteresting to the reader to learn something about the origin and manufacture of Panama hats. This is given by Dr Seeman, in an interesting article on the vegetation of the Isthmus of Panama, in the *Journal of Botany*. An indigenous production, he says, deserving of especial notice, is the "Jipijapa" (*Carludovica palmata*, R. and P.), a palm-like plant, of whose unexpanded leaves the far-famed "Panama hats" are plaited. This species of *Carludovica* is distinguished from all others by being terrestrial, never climbing, and bearing fan-shaped leaves. The leaves are from six to fourteen feet high, and their lamina about four feet across. The spathe appears toward the end of the dry season, in February and March. In the Isthmus the plant is called "Portorico," and also "Jipijapa," but the latter appellation is the more common, and is diffused all along the coast as far as Peru and Chili; while in Ecuador a whole district derives its name from it. The plant is common in Panama and Darien, especially in half shady places, but its geographical range is by no means confined to them. It is found all along the western shores of New Granada and Ecuador; and has been found even at Salango, where, however, it seems to reach its most southern limit, thus extending over twelve degrees of latitude from north to south. The Jipijapa, or Panama hats, are principally manufactured in Veraquas and Western Panama. Not all, however, known in commerce by that name are plaited in the Isthmus; by far a greater proportion being made in Manta, Monte Christi, and other parts of Ecuador. The hats are worn almost in the whole American continent and the West Indies, and would probably be equally used in Europe did not their high price (varying from $2 to $150) prevent their importation. They are distinguished from all others by consisting only of a single piece, and by their lightness and flexibility. They may be rolled up and put into the pocket without injury. In the rainy season they are apt to get black, but by washing with soap and water, besmearing them with lime juice, or any other acid, and exposing them to the sun, their whiteness is easily restored. So little is known about these hats, that it may not be out of place to give an account of their manufacture. The "straw" (paja), previous to plaiting, has to undergo several processes. The leaves are gathered before they unfold, all their ribs and coarser veins removed, and the rest, without being separated from the base of the leaf, is reduced to shreds. After having been exposed to the sun for a day, and tied into a knot, the straw is immersed in boiling water until it becomes white. It is then hung up in a shady place, and subsequently bleached for two or three days. The straw is now ready for use, and in this state sent to different places, especially to Peru, where the Indians manufacture from it those beautiful cigar cases, which sometimes bring as high as $30 each. The plaiting of the hats is very troublesome. It commences at the crown and finishes at the brim. The hats are made on a block, which is placed upon the knees, and requires to be constantly pressed with the breast. According to their quality, more or less time is occupied in their completion—the coarser ones may be finished in two or three days, while the finest may take as many months. The best times for plaiting are the morning hours and the rainy season, when the air is moist. In the middle of the day and in dry clear weather, the straw is apt to break, and this, when the hat is finished, is betrayed by knots, and much diminishes the value.

THE PROTECTION OF WOODWORK.

It not unfrequently happens, when a frame structure is hastily erected, and in our country they are always hastily erected, especially bridges, that a good oil paint is properly applied, and yet in a comparatively short time it begins to peel off more or less completely, making it necessary to repaint them. What is still more unfortunate, some timber, which has had a good coat of oil or tar paint that did not peel off, begins to decay in a short time, so that the original intention of the paint is not fulfilled, but, on the contrary, the paint itself seems to hasten its destruction.

These and similar circumstances lead people to distrust paint as a wood protector, and from different quarters we hear the assertion that unpainted wood will last longer than it would if painted.

This view, says Engineer Sauerwein, requires modification. In judging this matter we must ask how long was it from the time the wood was felled until it was painted, and was it dry or not, for these unfortunate cases have only occurred in wood which were painted too soon.

It is well known that the sap of wood contains substances like albumen, gelatine, gum, etc., which easily undergo decomposition, and under certain circumstances, such as favor fermentation, and in warm damp air, are able to destroy very rapidly the stronger woody fibers. The more sap there is in the wood, that is to say the greener it is, and the sooner the evaporation of this sap is stopped by an airtight cover, the quicker the fermentation will set in, and with it the destruction of the woody fiber.

These circumstances are correctly understood by practical men, who prescribe that the timber be felled in winter, and try to obtain a free circulation of air through the structure.

They think they avoid the disadvantages above mentioned if they, further, demand "seasoned wood," because it is clear that there is less danger of decomposition in such wood than in fresh or green stuff. But here we at once stumble on this difficulty, namely, of determining what degree of dryness in the wood to be tested seems most advantageous for its use, and the time required for this is much longer than generally supposed. The appearance of the wood is very seldom a reliable guide, and people are accustomed to think that the wood is much drier than it really is. The comparatively important changes which the wood undergoes during the first year from shrinkage enable us to measure approximately the time necessary to destroy the last evil effects of its interior life. Not until it has reached this stage, which requires four to six years, unless artificial seasoning is resorted to, is the timber benefited by covering it with a protecting coat of paint. At this time the paint must have a beneficial effect in protecting the wood, for it prevents atmospheric moisture penetrating into the wood to serve as a reagent to decompose the albumen, which is now dried and coagulated as well as less abundant.

Owing to the position of the lumber yards and the urgency for materials to build with it is seldom possible to obtain well seasoned lumber and wood. Sauerwein, therefore, proposes the following process:

The most rational and sensible process for large, heavy timbers is the impregnation, as for railroad ties, with chloride of zinc under six to eight atmospheres of pressure, where this can be done. (Fresh green wood is best for this.) No arguments are necessary in defense of the value of this method; it cannot be too strongly recommended, nor is the expense great—about $1 per cubic meter. When there is no opportunity for impregnation the woodwork should be left two or four years unpainted.

In my experience, says Sauerwein, wood tar is better than coal tar, because it penetrates into the wood more easily, and, containing a larger amount of antiseptic substances, its effect is more permanent. Although wood tar is considerably dearer it is to be preferred. Its color being somewhat similar to wood color it can be used on small unimportant buildings. Its cost is only one-fourth that of oil paint and can be applied by a common workman.

Planed and worked surfaces should be merely oiled (three times) not painted. Besides having a better appearance, this oil varnish is necessary to prevent cracking and drawing of thin parts like doors and windows. It does not interfere with the gradual drying out of the wood.

After the expiration of three to five years the oiling may be replaced by a protecting coat of paint to prevent water from penetrating into the wood work. It should be added that it seems advantageous to mix about one part of elutriated chalk with three parts of the white lead which is used with the special color for all oil paints. This seems to make the paint adhere better to the wood, as shown by experience.

Without going into the subject of oil paints the author cautions the public against the many new fangled and highly extolled paints and substitutes. They are generally much dearer, he says, and at best are only equal to ordinary linseed oil paint made with equal care from well selected pure material. The chief effect of a good oil paint depends on the purity of the materials used, especially of the oil and white lead or zinc white, whether it is finely ground and thoroughly mixed, and the paint carefully applied in good weather.

THE BARTHOLDI STATUE OF LIBERTY.

The completion of the subscription for the statue of Liberty on Bedloe's Island, New York harbor, was celebrated by a grand banquet in Paris, July 7. M. Laboulaye presided. Among the principal guests were M. Ferdinand de Lesseps; M. Lepère, late Minister of the Interior; General Pittie, Chef de la Maison Militaire of President Grevy; Oscar de Lafayette; Henri Martin, the historian; Victorien Sardou; General Noyes; Consul General Walker; and M. Bartholdi, the sculptor of the statue.

An address to the people of the United States—signed by the French participants at the banquet, and indorsed by 181 towns, represented by votes of municipal councilors, forty conseils-generaux, ten chambers of commerce of the most important towns, and 100,000 subscribers—announces that the statue will be finished in 1883, and erected on a monumental pedestal on Bedloe's Island. The preparation of a suitable foundation devolves, we believe, upon the American public. It is to be hoped that there will be no delay in completing the work. The placing and inauguration of the statue may form an appropriate feature of our World's Fair celebration in 1883.

49th Exhibition of the American Institute.

The annual exhibition of the American Institute, of the city of New York, will open September 15. The Board of Managers announce a novel and very promising feature, namely, an exhibition of the work of amateurs and apprentices in all branches of mechanical, industrial, and decorative art. Such exhibits will be admitted free of charge, and premiums are offered for the best. To pass upon exhibits of this character the Institute proposes to add to the corps of judges ladies who are proficient in art work, in which department are embraced sculpture, painting, drawing, bric-a-brac, fancy work, embroidery, decorated china, wood carving, sawing, and all other artistic handwork calculated to adorn American homes.

NEW CANAL IN CHILI.—The *Chilian Times* announces the completion of the Canal de la Merced. The canal is seventy-five miles long, and has been twenty-five years in construction. It is considered one of the most important works executed in Chili. It has cost about $400,000.

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MECHANICAL INVENTIONS.

An improved leather finishing machine has been patented by Mr. Fred B. Batchelder, of East Boston, Mass. The object of this invention is to furnish a machine for applying blacking, paste, blood, stains, or other mixture or dressing to surfaces of leather and other materials, in such a way that the opposite surfaces may be kept practically clean.

A new and improved pitman rod for mowing machines, so constructed that its bearings can be easily adjusted in case they become worn out, has been patented by Mr. David Horn, of Mohecanville, O. The invention consists in a pitman rod with a circular beveled adjustable socket, into which a beveled circular stud on the cutter head of the mowing machine fits at one end, and a beveled aperture into which a beveled sleeve or thimble mounted on a pin of the pitman wheel passes at the other end.

Heretofore balance staffs for watches have been made in one piece with the collet rigidly attached to the staff, and the collet formed with a countersunk end for entering the balance wheel center, the parts being attached firmly by riveting down the countersunk end of the collet. With this construction the work of replacing a broken staff with a new one involves considerable labor and risk of injury to the balance wheel. Mr. George G. Bugbee, of Gonzales, Texas, has invented a balance staff and wheel for watches, so constructed that a broken staff may be replaced with little labor and expense, and without risk of injury to the wheel. The invention consists, first, in attaching the collet permanently to the balance wheel; and, second, in connecting the staff thereto by a wedge or screw joint, by which the staff is rendered adjustable, and may be readily removed.

IMPROVED ROTARY PUMP.

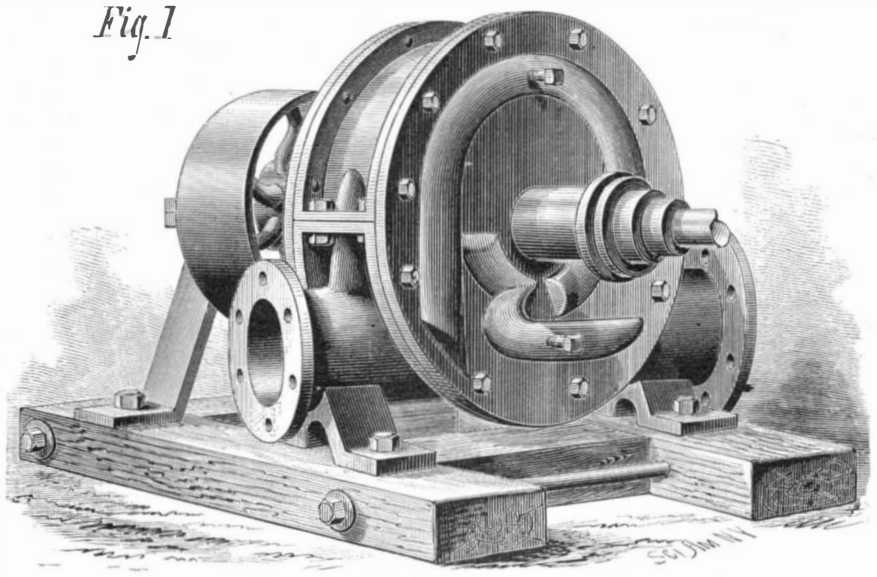
The rotary pump herewith illustrated was designed with a view to obtaining a pump for general use, simple, and easily constructed, requiring the least amount of power to operate it, and which should wear well and be easily and quickly repaired. The general idea of a pump made in this manner is not new. But in the manner of working the floats a new feature is introduced, neither springs nor cams being used to operate them. This action is accomplished by direct water pressure acting through passages or ports, E F, in the face of the pump heads, as shown in dotted lines in the sectional view.

The pump consists of an outer case of two pieces joined on a central line. The upper half is bored cylindrically, having its center coincident with the center of the shaft, while the lower or bed piece is bored from two centers eccentric to the shaft, forming a central cam projection. As the centers are all on the line of the junction of the two parts of the casing, it will be seen that by bolting together two corresponding parts of two pumps much time and labor may be saved in boring out the shells. The inside cylinder, A, fits accurately between the two heads, and contains in this case three slots for movable floats. The heads are made "rights and lefts," in order to have the canals in their faces correspond.

When the pump turns in the direction of the arrow, then H is the inlet and G the outlet, and the space in the cylinder on the outlet side and passage, F, will be under pressure, while none will exist in the inlet side nor in the passage, F. The float, D, is ready to go out into position, and therefore pressure is brought to bear on its inner end, through the passage, E, which pushes it out. After passing the junction line of the two parts of the casing the passage, F, is passed and the slot remains full of water. When the float arrives at the opposite side of the casing it is relieved of lateral pressure. Then the water in the slot empties itself through the passage, E, while the pressure at G pushes in the float. Three slots full of water are thus lost every revolution, otherwise the pump may be termed "positive."

The inventor claims that there is scarcely any wear between floats and upper half of shell, as there is nothing to push them out after passing the horizontal central line; that the pressure in the discharge side keeps the floats clear from the cam at the bottom of the casing. By adjusting the area of canals, E F, by plugs or valves, nearly all wear may be avoided on the cam. An adjustable piece may be used to counteract wear at the lower part of the casing. The passages in the heads serve to lubricate ends of cylinder, A. In large pumps for constant use, and sometimes in the smaller sizes, the floats may be made of wood—rock maple—which is said to last several months under constant usage, and when worn the floats are easily replaced. When wooden floats are used the inventor places a small rubber cushion in the bottom of each slot. This pump works lightly without jarring, and will run in either direction.

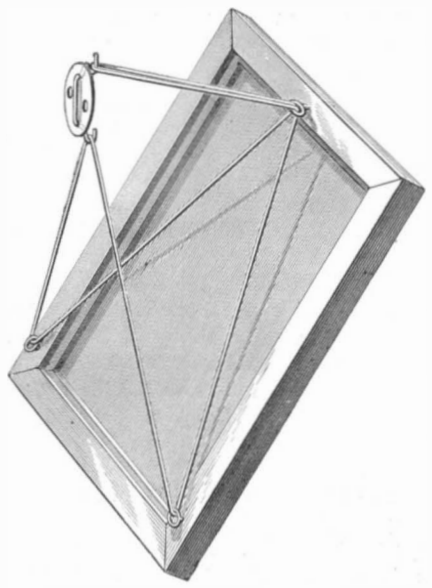
Further information may be obtained by addressing the inventor, E. B. Newcomb, Cumberland Mills, Me.



NEWCOMB'S ROTARY PUMP.

IMPROVED PICTURE HANGER.

The engraving shows an improved hook to be fastened to the wall, and a novel arrangement of the picture cord in relation to the hook and to the frame to be suspended, which admits of placing the frame at any desired angle by simply moving it so that the cord slides through the screw eyes. This arrangement is specially adapted to mirrors, as it admits of adjusting them to such angles as are most agreeable to the eye, according to the size, height, and distance of the mirror from the user.



MARSDEN'S PICTURE HANGER.

This invention was recently patented by Mr. Mark W. Marsden, of Connersville, Pa.

The Manufacture of Spools.

The prevalence of white birch along the St. Francis River above Drummondville, Canada, has made that town an important center for the production of spools. When received at the factories the wood is first sawed into strips about four feet long, and from one inch to an inch and a half square, according to the size of the spools to be made. The wood is thoroughly dried, then roughly turned, cut into lengths for spools, and bored.

The machines used for this purpose are revolving planers, in the center of which is a revolving gimlet or bit, and immediately to the right a small circular saw with a gauge set to the proper size for the spools. The roughers receive one and a half cents per gross for their work, and experienced men can turn out about one hundred and thirty gross per day. The round blocks pass from them to the finishers, who place them in machines which give them the shape of spools, and make them quite smooth. The spools are thrown loosely into a large cylinder, which revolves slowly, so that the spools are polished by the constant rubbing upon each other for some time. On being taken out of the cylinder, they are placed in a hopper with an opening at the bottom, through which they pass down a slide for inspection. Here the inspector sits and watches closely to see that no imperfect spools are allowed to pass; and a very small knot or scratch is sufficient to condemn them. They are packed in large boxes, made the proper size, and no additional packing is needed. The packers receive one-quarter cent per gross for packing, and a smart boy who is accustomed to the work can pack about 200 gross per day. One proprietor ships over 2,000,000 spools per month to England, and another firm ships over 1,000,000 spools to Glasgow, Scotland.

Paper from Bagasse.

The conversion of bagasse into paper stock at home is attracting considerable attention in Louisiana. Several parties in the North and West have tested the fiber produced from it by a new process, and speak of it as extremely promising. The chief difficulty at present appears to be in the bleaching process; but that, it is thought, can easily be overcome and the fiber made perfectly white. By converting the bagasse into fiber on the plantations three-fourths of the transportation charges will be saved. Louisiana produces 200,000 hogsheads of sugar a year; and the cane for each hogshead will yield one ton of paper fiber.

ENGINEERING INVENTIONS.

An improved process and apparatus for remelting soap, has been patented by Messrs. William Cornwall, Jr., and Aaron W. Cornwall, of Louisville, Ky. This invention relates to an improved process of remelting scrap soap or broken soap for the purpose of making it into soap of marketable form and quality. The process consists in subjecting the scrap or pieces of soap to the action of dry superheated steam. The mass of scrap is agitated or stirred by revolving arms, while the steam is allowed to enter it at the bottom of the tank or vessel in which it is contained.

A sectional turbine water wheel, so constructed that the sections may be easily put together and will be held firmly in place, has been patented by Mr. William Sims, of Stayton, Oregon. The invention consists in constructing the sections with inner rims having their ends rabbeted, inclined buckets, and outer rims made thicker than the inner rims, to give the inclined buckets a slight twist.

Messrs. John G. McAuley and William West, of Denver, Col., have patented a device for feeding coal dust and other pulverized fuel to smelting or other furnaces. It is an improvement upon that form of feeder in which a falling stream of the pulverized fuel, fed by a spiral conveyer or otherwise, is struck by a blast of air, which at the same time acts as a vehicle for the further transportation of the fuel to the fire chamber, and supplies the necessary admixture of oxygen for its combustion.

Mr. Gordon W. Hall, of Havana, N. Y., has invented a propeller having a hollow portion arranged to turn in the dead water under the stern of the boat and connected by a pipe with a condenser.

Mr. John W. Kramer, of New York city, has patented a portable turn-out or turntable for railways, especially street railways, whereby cars may be shifted from one track to another, or turned end for end, if necessary, when obstructions occur in the line. The invention consists in a frame fitted for being pinned to the ground between the tracks and carrying a pivoted section of rails, which may be turned to coincide with either track to receive the car, and then turned, as desired, to shift the car to the other track.

Mr. George M. Fenley, of Medora, Ind., has invented an improved drift wheel for preventing drifts, rafts, or logs from stowing against bridges, piers, or docks. It consists of a cylinder armored with spikes and vertically pivoted in front of a pier, dock, or similar structure, so that when the drifts or floating logs strike this wheel they rotate the same and slide along.

Mr. Alonzo Jillson, of Racine, Wis., has patented an improvement in traction engines. The invention consists in combining sliding journal boxes, slotted hangers, and adjusting screws with a cross shaft and wheels, the object being to readily throw the drive wheels into or out of gear.

An improved car coupling has been patented by Mr. Sylvester F. Newland, of Waynesfield, O. This invention relates to that class of couplers called "self-couplers;" and it consists of a five-pronged spring-actuated coupling pin, which is held and guided between two vertical standards that are fixed on top of the draw head.

An improved hoof parer, patented by Mr. James York,

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of Coalesburg, Mo. It consists in certain novel details of construction, arrangement, and combination of a base and standard, a leg rest, a clamping device, and means for operating the paring knife, whereby the operation of trimming and paring the hoof is accomplished with economy of time and labor to the workman and more ease and comfort to the animal.

AMATEUR MECHANICS.

LENS MAKING.

To make an ordinary lens requires a certain degree of manipulative skill, but when compared with a fine job of filing, fitting, or even turning, it is easy, and there is a charm about making a nicely polished lens which is not found in metal working. The tyro should commence with small plano and double convex lenses, which he may mount singly or in pairs. After attaining a fair proficiency in making these he may proceed to larger work, and afterward by coupling study with practice he will be able to make fine work, such as the achromatic objectives of microscopes and telescopes, eye-pieces, lantern objectives, etc.

The first thing to be done in the way of the preparation of tools for lens grinding is to make gauges or patterns with which to gauge the convexity of the grinding tools. These may be made from pieces of sheet brass about one thirty-second inch in thickness, the plates for gauges for convex tools being chucked on a plane board secured to the face plate of the lathe, and the circular aperture turned out. The plate should be beveled each way from the aperture, forming a knife edge, and it should be separated by a saw into two or four parts, according to the size of the lenses to be ground, as shown in Fig. 1. The radius of the circle so formed will be approximately the focus of a double convex of this curvature, and the diameter of the circle is approximately the focus of a plano-convex lense of the same curvature.

Gauges for concave tools or concave lenses are made by turning disks of brass with V-shaped edges, as shown in Fig. 2, and an instrument for shaping small concave grinding tools is shown in Fig. 3. It consists of a sharpened steel disk attached to or formed upon the end of a bar, and used as a scraper for giving the final shape to the concave grinding tools.

For grinding convex lenses it is well to have two concave tools like that shown in Fig. 4. This as well as other grinding tools for small work should be made of brass. Drawn brass is preferable, as it is usually better metal, and more homogeneous than castings, and needs no external turning.

Having determined on the focus of the lens to be ground, the brass is chucked in the lathe, and hollowed out as nearly to the correct form as possible, the gauge shown in Fig. 2 being used from time to time to determine when the proper concavity is reached. The grinding tool is finally scraped with the cutter shown in Fig. 3. The counterpart of the concave tool shown in Fig. 5 is now turned as nearly to the gauge shown in Fig. 1 as possible, and is finally ground into the concave tool with washed flour emery and water.

A tool like that shown in Fig. 6 is necessary for finishing small lenses. It consists of a cylindrical piece of brass, having a chamber turned in the end for the reception of a mixture of pure hard beeswax and fine rouge. This mixture should contain sufficient rouge to make it rather hard, but not so hard as not to yield under strong pressure.

The glass for small lenses may be clipped from bits of plate (crown) glass and roughly shaped by means of an ordinary pair of pliers. It may then be cemented with pitch to the end of a round stick, as shown in Fig. 7. The glass is then ground on a common grindstone until it approximates the required shape. It is then polished with fine emery and water in one of the concave brass tools until a truly spherical surface is secured. It is then transferred to the other brass tool, and ground with fine washed flour emery until the surface is fine and entirely free from scratches. During the grinding as well as polishing the stick to which the glass is cemented must be turned axially, and at the same time its outer end must be moved about the prolongation of the axis of the grinding tool so as to present the glass to every portion of the grinding tool as nearly as possible.

The final polish is secured by pressing the smoothed glass into the wax in the end of the tool shown in Fig. 6 as the tool is revolved, and at the same time applying fine rouge and water from time to time. When the polish is nearly perfect the tool should be allowed to work nearly dry.

For a plano-convex lens the plane surface of the plate glass will answer very well for the plane surface of the lens, and the glass will be ground down as shown in Fig. 8. If the lens is to be double convex the finished spherical surface should be cemented to the end of the stick, and the opposite side proceeded with as before described. There are two methods of finishing the edges of plano-convex lenses: first, by holding the plane surface in a concave tool charged with emery and water until the edge is beveled to the required degree; and second, by chucking the lens on the end of a spindle projecting from the lathe mandrel, and centering it while the pitch or cement which holds it is still warm. Then a piece of brass, which is concaved to conform nearly to the periphery of the lens and charged with emery and water. This tool is held against the edge of the lens after the manner of turning. The lens will soon assume a perfectly circular shape, and may be readily reduced to any desired size.

In making concave lenses the convex tools will be used, and the final finish will be given by a piece of silk cemented to the tool with pitch and charged with rouge and water.

For grinding larger lenses of longer focus an attachment like that shown in Fig. 10 will be required. It consists of a wooden box supported by a curved arm inserted in the tool

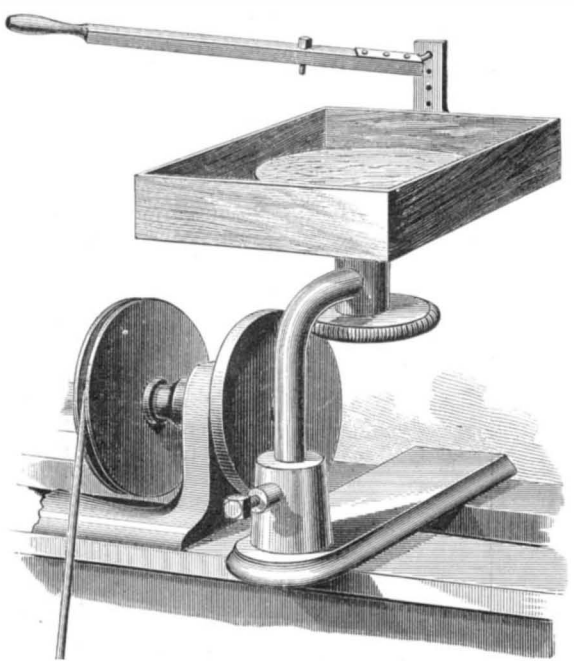
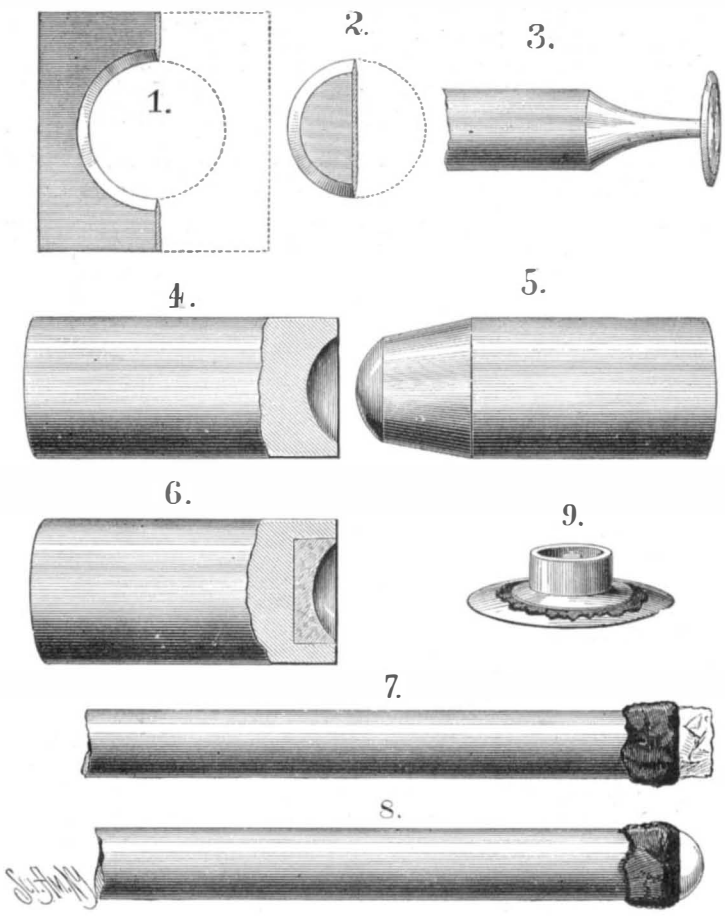


Fig. 10.—LENS GRINDING ATTACHMENT FOR FOOT LATHES.

rest support. A vertical journal box passes through the bottom of the box, and contains a shaft having upon its upper end a socket for receiving the grinding tool, and on the lower end a grooved wheel surrounded by a rubber friction band, which is revolved by contact with the face plate of the lathe. The speed of the wheel relatively to that of the lathe may be varied by raising or lowering the shaft by raising or lowering the box support in the tool port.

The glass to be ground is cemented to the face of a flanged casting as shown in Fig. 9, and is held down to the grinding tool by the lever attached to the box. The tool for large work may be made of cast iron. The center of the lens should be eccentric to the center of the grinding tool, so that the lens will be revolved on the face of the tool. The point



TOOLS FOR GRINDING SMALL LENSES.

projecting from the lever enters a small cavity in the center of the casting, to which the lens is attached and insures an equal distribution of pressure over the entire surface of the lens.

Grinding and finishing a large lens is substantially the same as in the case of the smaller ones, the only difference being in the method of giving the final polish. In the case of a large lens, after the fine grinding, the tool is heated, covered with a thin coating of pitch, and a piece of thin broadcloth is pressed down on the pitch. This broadcloth surface is charged with fine ronge and water, and the lens is pressed down on it with considerable force as the tool is revolved. The cloth should be worked rather dry, and so much so at the end of the process as to offer considerable resistance to the rotation of the tool. M.

MISCELLANEOUS INVENTIONS.

An improvement in casting chilled mould boards, patented by Mr. Burnett B. Harris, of South Bend, Ind., consists in the combination, with the lower part of the flask having an opening in its bottom, of the chill having rabbeted edges and the buttons, so that the chill will be held securely in place and allowed to expand and contract freely; also, in the combination, with the chill and the mould board pattern, of core cups having tapering holes, so that the patterns can be removed without disturbing the bolt hole cores or dies. The lower parts of the flasks have openings in their sides, communicating with the connecting flues, so that the chills of a series of flasks can all be warmed at the same time and by the same furnace.

Mr. Samuel M. Wright, of Wagoner's Station, Ind., has invented an improved rein holder which is simple and convenient. It consists of a curved rod provided with a heart-shaped crutch at its upper end for receiving the reins. This rod is adjustably fastened in a frame attached to the dashboard of a vehicle.

Mr. Henry W. Fuller, of Seneca, Kan., has patented a reversible and double buckle having six bars, forming five loops, and provided with two tongues set opposite each other, but one pointing to the right, the other to the left, each tongue having its respective tongue bar and tongue rest bar.

An improved armature for electro-magnets has been patented by Mr. Peter Wagner, of New York city. The object of this invention is to increase the surface of attraction between the armature and the poles of the magnet, and thus augment the power of the electro-magnet and increase the length of the swing of the armature.

A combined forge and steam boiler has been patented by Mr. David E. Engle, of Jacksonville (Wind Ridge P. O.), Pa. The object of this invention is to utilize the heat developed in forge fires to generate steam for driving a fan blower and other machinery.

Mr. James A. Fancher, of West Granby, Conn., has invented a velocipede, whose movements, it is claimed, can be more easily and readily controlled than the movement of any of the velocipedes in common use. The invention consists in a peculiar combination of mechanical devices, which cannot be clearly described without engravings.

Mr. John L. Sippy, of Venice, Ill., has invented a simply constructed, light, and easily worked extension ladder, to be used by carpenters, builders, firemen, and others who often require a ready means of reaching an elevated position.

An improvement in dumping wagons has been patented by Mr. George B. Wiestling, of Mont Alto, Pa. The object of this invention is to furnish safety catches for dumping carts, wagons, and other vehicles, so constructed as to hold the loaded bodies of the vehicles from dropping back should the hoisting mechanism break.

A miner's lamp so constructed as to conduct the flame upward when moved forward, so that it will give more light and also protect the top of the lamp and the head of the miner from the flame and heat, has been patented by Mr. Louis Weihe, of Connellsville, Pa.

Mr. John Thompson, of Oakland, Md., has patented a compact and convenient machine adapted for the use of druggists in putting up prescriptions in pill form of any usual size.

Mr. Joseph S. Letourneau, of Tucker, Ill., has patented a device for use in raising the boxes of dumping wagons, whereby the power of the team can be used for raising a loaded box to dump it, and the labor and expense of shoveling thereby saved. The device is especially intended for use by farmers, and with four wheeled wagons the boxes of which are fitted for being raised at the forward end bodily. The invention consists in bars or rods recessed at one end for taking over the wheel spokes and formed with shoulders to take under the wagon box, so that when said rods are applied to the forward wheels and box and the wagon backed the rods will rise and lift the box. The inventor states that with this device it is an easy matter to unload a wagon load of fifty bushels of corn or sixty bushels of oats in three minutes.

An improved blinder for bridles has been patented by Messrs. George A. Gregerson, of Rochester, and Charles O. Weymouth, of Olmsted county, Minn. The invention consists in the combination with the blind plate, of metallic hinge plates for connecting the blind with the head piece and the bit strap.

An improved nut lock, patented by Mr. William S. Mitchell, of New Cumberland, Ohio, belongs to that class of

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inventions that have for their object the securing of nuts on railroad tracks, bridges, machinery, etc. It consists of hinged lock plates provided with beveled sockets to fit over the nuts, the lock plates having their free ends locked together by lock and key.

Mr. Emery O. Bicknell, of Boston, Mass., has patented an envelope having bronze aniline lines arranged on the outside of the flaps and a little back of the edges, the lines being adapted to change color if the envelope is tampered with by the application of steam or moisture.

An improvement in churn powers has been patented by Mr. George W. Sampson, of Tecumseh, Kan. This invention relates to that class of churns that are provided with two dashers, set. one above the other, and operating with a reciprocating vertical motion.

An improved separator for the distillation of whisky has been patented by Mr. Martin V. Monarch, of Ownesborough, Ky. The inventor utilizes the heat of the low wines or vapors thereof as they pass to the condenser for heating the charge for the still to nearly the boiling point, and at the same time the escape of the alcoholic vapor arising from the charger is prevented, and mealy or improper substances are separated or eliminated from the low wines.

An improved thill coupling, patented by Mr. Frank P. Johnson, of Eyer's Grove, Pa., consists in a novel construction and arrangement of a spring and a locking lever, and the combination thereof with the thill iron and clip, whereby the coupling and uncoupling of the thill and holding the same securely in place are facilitated.

Mr. Sylvester W. Sheldon, of New York city, has patented a device applicable to barrels of different sizes, for supporting them so that they may be easily moved within fixed limits. It is designed for the use of grocers, housekeepers, and others, who are frequently obliged to remove barrels from under shelves and to replace them. The invention consists of two principal parts—a pivotal support for one side of the barrel and a jointed roller support for the other side. The pivotal support has a base plate containing a cavity for the reception of a pivot, carrying at its upper end a curved plate provided with two notched projections for receiving the chine of the barrel. The roller support is made in two parts hinged together to adapt it to barrels of different sizes, and supported on rollers, one roller being pivoted in each part.

Mr. Charles D. Hoffman, of Cairo, N. Y., has patented an improvement in the class of washing machines in which a suds box is mounted on rollers that run on horizontal rails and is reciprocated by means of a crank and pivoted connecting rod.

A combined clothes rack and mantel, which is simple and convenient, has been patented by Mr. Charles C. Field, of Crete, Neb. It consists in a hollow lintel having the front side pivoted at its lower edge and the upper part solid, and provided with a series of radiating recesses in front, in combination with bars.

An improvement in stock cars which will permit the loading of cars very rapidly, afford plenty of space for the animals, and permit their feeding conveniently, has been patented by Mr. Edgar G. Frisbie, of Monroe, Mich. The car is subdivided into several compartments by a longitudinal partition and several transverse hinged gates provided with spring latches. It is provided with troughs partitioned into two subdivisions, one for water, the other for feed.

An improvement in the class of mortise and rim locks having keyhole guards consisting of pivoted plates adapted to swing over the keyhole and prevent the insertion of picks on the outer side of the lock whenever a key is inserted on the inner side, has been patented by Mr. Josiah H. Browne, of Salem, Mass. The improvement consists in the construction and arrangement of sliding guards and the devices which co-operate with them, so that the movement of one guard causes the opposite movement of the other.

An improved headlight case, patented by Mr. Robert C. Greenland, of Connellsville, Pa., consists, principally, in a novel arrangement of oscillating valves for securing a uniform ventilation of the case, also in arranging the door so as to obtain an air-tight joint and a device for more securely fastening the door; and in connecting the top of the case with the dome by means of a double hinge, so as to permit the top to be opened in two directions.

Mr. Henry R. Robbins, Md., of Baltimore, has patented a novel form of press for forming a special construction of can-head, which head is made in one piece, with a skirt or flange at right angles to the main portion, and with a swell or bulge at the corner.

Mr. John T. Hodge, of Carter's depot, Tenn., has invented a convenient and simple device for containing and delivering groceries and other articles to scales to be weighed, thereby avoiding the necessity of keeping such articles in boxes and barrels under and about shop counters, and avoiding also the inconvenience and labor of frequently handling such boxes and barrels. The invention consists of a series of hoppers or equivalent receptacles placed on the floor of the room above the shop counter, and of pipes or tubes leading from each one of said hoppers or receptacles down to within a short distance of the counter, so that the scales can be placed under the mouths of these pipes to receive the contents therefrom, the pipes being provided with gates or slides to regulate the delivery of articles from them.

FONVIELLE & LONTIN'S ELECTRICAL MOTOR.

This little apparatus, which was presented to the Academie des Sciences at its session of April 5, is composed of a galvanometric helix (Fig. 1) in which there is a small soft iron disk capable of revolving on its supporting pivot. If, on arranging a horseshoe magnet over this apparatus in such a way that its polar extremities are at the ends of the frame, an induction current from a small induction coil be sent into the wire of the helix, the disk begins to revolve rapidly

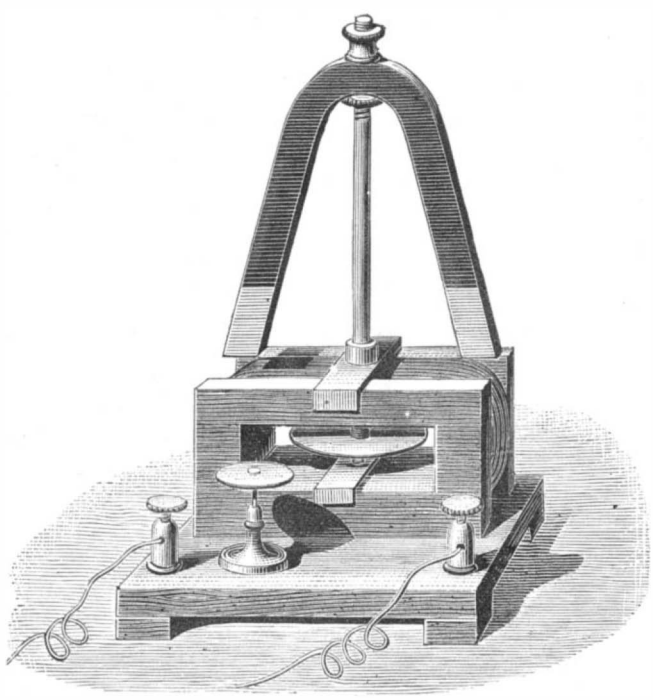

Fig. 1.—FONVIELLE & LONTIN'S ELECTRICAL ROTATOR.

and in a perfectly definite direction, which is dependent on the position of the poles of the magnet and on the direction of the currents induced in the wire of the galvanometric helix. When the magnet is crosswise, there is no longer any rotation. The phenomenon has been explained very simply by MM. Jamin and Du Moncel. As well known, the current induced by breaking is always more powerful than that induced by closing. The disk of soft iron polarized by the outer magnet behaves like a magnetized needle placed in a galvanometric helix, and assumes its motion under the action of a series of electrical impulses, the poles remaining fixed in space, while the disk displaces itself by its rotation. The current produced by closing the primary circuit of the induction coil acts in a direction opposite to that produced by opening, but as its intensity is much less, the disk moves under the differential action of the two. Each current induced by closing produces a new impulse on the disk, since the poles are always in the prolongation of the fixed magnet.

The same rotatory motion is produced with the *direct current of the battery interrupted with sufficient rapidity*. In this case the rotary speed is not so great, but this must be attributed to the fact that the electrical impulses are not produced with sufficient rapidity, and that, moreover, the resistance of the galvanometric helix is not so well adapted to

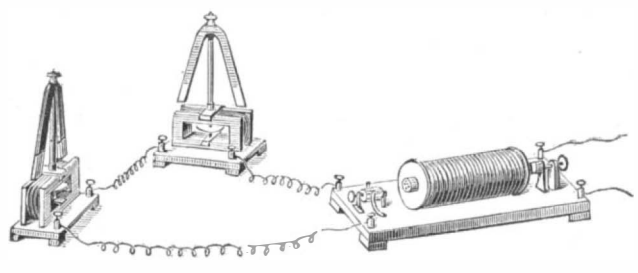

Fig. 2.—Arrangement of two rotators mounted in tension in the induced circuit of a Ruhmkorff coil.

the direct current. The motion is quite rapid when the current of the battery is sent and made to traverse the inductor of the coil and the vibrator, for there is then produced a series of impulses which are sufficiently rapid to communicate a certain rotary speed to the disk. On arranging two helixes (Fig. 2) in the circuit of the secondary wire of the coil, a movable disk may be made to revolve in each helix; but on removing the disk from one of the helixes the disk in the other takes an accelerated velocity. To explain this phenomenon, which appears to have somewhat astonished M. De Fonvielle, we have only to bear in mind the well-known reactions of magnets and currents. The rotatory motion is produced also with movable pieces of soft iron of various shapes—needles, stars, whole disks, split or annular, spiral bands, etc. On doing away with the fixed magnet the phenomenon takes place under the action of terrestrial magnetism, although to a less degree. The fact that there is no motion when the magnet is placed crosswise with the spirals of the galvanometer, proves the exactness of M. Jamin's theory; for, in this case the disk in the interior of the galvanometric helix forms, under the influence of the external horseshoe magnet, a true magnetized bar placed crosswise with the current, and consequently cannot assume any motion under its action. MM. Lontin and De Fonvielle's apparatus constitutes a new and original form for demonstrating the laws which govern the action of magnets and currents, and, as such, will take its place in physical cabinets alongside of analogous apparatus of Ritchie, Barlow, Faraday, etc.

Curious Intermittent Spring in Guatemala.

M. De Thiersant, Chargé d'Affaires of France in Guatemala, gives, in *La Nature*, the following account of a phenomenon witnessed by him in the last named country. At about ten miles from the capital, near a town called Nejapa, on the lowest declivities of the volcano of San Salvador, there is a spring known in the country under the name of Rio Huido (fleeting river), which, for a period of seven consecutive years, furnishes enough water to form a true river. The waters of this spring are crystalline and wholesome, and, it is said, are excellent for certain diseases like leprosy, and for strengthening the system when debilitated by the climate. As soon as the seven years are completed, these same waters disappear at a certain definite hour, the spring ceases to flow, and the river bed, becoming completely dried, exhibits thereafter nothing but sand and dust. The intermittent periods have been as follows: From 1866 to 1873 the waters flowed; from 1873 to 1880 the spring ceased; and in the month of January of the present year, the spring began to flow again. This phenomenon is doubtless not a new one, and science has long ago explained it, but there do not perhaps exist many springs the intermittent period of which is so long and so regular as that of the one at Nejapa.

Hallucination of the Senses.

Professor Maudsley remarks, in a recent lecture, that one striking feature observed by medical men who have had cases of hallucination under their charge is that the patients cannot be convinced that the objects they see, the sounds they hear, and the smells they perceive, have no real existence, and that the sensations they receive are the result of their excited nerves. It frequently happens, too, that a person who suffers from hallucination in respect of one sense has the others unaffected, and is, on all other matters, perfectly normal. Hallucination may arise either from an idea on which the mind has dwelt, appearing as something exterior, or from excitement of the sensory ganglia. It is said that Newton, Hunter, and some others of equal professional eminence, could, at will, picture forms to themselves till they appeared to be realities.

NEW INVENTIONS.

An improved wagon axle has been patented by Mr. John B. Herman, of Blair, Nebraska. The object of this invention is to furnish wagons so constructed as to run easier than when constructed in the usual way, and in which the bearings can be kept oiled and the brake can be readily applied.

An improvement in that class of vertically revolving windwheels having radial feathering sails or vanes, which are adjusted, according to the force of the wind acting on them, by means of a lever or governor vane, has been patented by Mr. Andrew D. Worman, of Frederick, Md.

An improved machine for packing meats into cans has been patented by Mr. William Steuerwald, of New York city. It is so constructed as to fill a can at one descent of the follower. It consists of a holder to receive the can, a top having a tapering tube to enter the hole in the can, a tapering hopper, and a contractible follower for forcing the meat into the can at a single movement.

Mr. John Law, of Lebanon, O., has patented a simple device to serve both to support the sides and back of the seat, and to hold the rails of a shifting-top buggy or other vehicle.

An improved clothes-pounder has been patented by John W. Troeger, of Naperville, Ill. This invention consists in an arrangement and combination of an outer cone and a series of inner cones provided with perforated concave diaphragms, whereby several advantages are obtained.

An improved bridle has been patented by Mr. John W. Aiken, of Tennessee, Illinois. The object of this invention is to lessen the amount of stock and labor required in making bridles, and at the same time furnish bridles that are neat in appearance, strong, and durable.

Mr. Robert E. Greenwell, of Osage Mission, Kan., has patented improvements in railway joints of that form in which a set of bolts project through the fish plates and have ends slotted lengthwise to receive a key which is driven in a plane parallel with the bolt. The invention consists in combining the fish plates, the slotted fish plate bolts, a key, and an elongated gib behind the key, which gib passes through two or more of the bolts and serves to tie them together and prevent them from being bent by the entrance of the key.

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AMERICAN INDUSTRIES.—No. 50.

THE WALL PAPER MANUFACTURE.

Among the many ways in which modern household decoration has been developed, perhaps no one occupies a more prominent position than the use of ready-made paper, instead of paint or tapestry, to cover the walls. And this method has become popular because of the degree of excellence which has been attained by manufacturers of wall paper within the memory of the present generation, the work now done being such as is sought after in the adornment of the most luxurious mansions in the world, while there is a great deal, also, the cost of which is so low that the lowest paid mechanic can afford to frequently brighten and freshen the walls of his living apartment therewith. A considerable manufacturing industry has, consequently, been developed for furnishing this one product, which affords no inconsiderable market for the paper manufacturer, and the dealers in colors, gums, and varnishes, besides giving employment to a large number of operatives. The illustrations on our first page this week give views of some of the leading operations in the conduct of this department of manufacture, as carried on by one of the leading houses in that line, Messrs. Christy, Shepherd & Garrett, at their large factory in West Twenty-third street, New York city.

Those who are in any way familiar with the art of printing will probably suppose that there is, from the start, some similarity between the processes of making letter-press work and the methods employed in producing the many-figured patterns which we find in wall paper. One does suggest the other throughout, but the means used and the mechanical part of the work are as different as the products. Wall papers are printed in water colors almost exclusively; very heavy pigments are used and stout bodies made, which require a great deal of time to dry, and these conditions also modify the character and substance of the type or blocks from which impressions are to be taken as well as the manner of taking them.

The "color mixing," an illustration of the department for which may be seen to the left hand at the bottom of the page, is one of the most important, as well as one of the most difficult branches of the business, where an extensive variety of fine wall paper is to be made. Besides the large room here shown for this purpose the firm have a special chemical department in an adjoining building at the rear, where they manufacture some of their own colors. In the mixing room, however, there may be found nearly every variety of earthy coloring matters, such as raw and burnt umber, sienna, etc., besides a good collection of mineral and vegetable colors, with an extensive assortment of gums and varnishes and the different kinds of clay which form the staple for making the body and carrying the color in every description of wall paper printing. The clay used comes principally from South Carolina and New Jersey. Both kinds are very nearly white, and readily divide into a fine powder, but the New Jersey clay has sufficient alum to render it best fitted for the second grounding in preparing the paper for "satining" or glossing. A large building in the rear is used for storing the clay, and a railway runs thence under the floor of the mixing room, 500 tons a year being about the amount of clay used here. The mixing of the colors is effected in large circular vats, in which arms operated from a shaft overhead are kept constantly revolving. From these vats the color is drawn off as wanted and transferred by a railway which runs through the room to an elevator leading to the various printing departments on the floors above.

On the basement floor, where the color mixing is carried on, is also the room for the reception of printing paper, which comes in rolls weighing about one hundred pounds each, and of just the regular width for wall paper, except such as is required for window shades, which is as much wider as may be desired.

The first part of the printing process, represented in one of the views at the top of the page, is the "grounding," or the covering of the whole white surface of one side of the paper with the ground color, on which the future patterns are to be printed. In this operation the color is put on the paper by brushes. Two wooden cylinders are arranged a short distance apart, carrying a wide belt of thick woolen cloth, the lower cylinder turning slowly in a trough containing the color, while a brush, operating against the cloth on the upper cylinder, transfers the color therefrom to the paper. The lower cylinder has a knife or rule pressing against the cloth as it comes out of the color, so that the quantity taken up may be regulated as desired. The brush which puts the color on has a slight, quick motion across the paper running through. The paper afterwards goes under brushes running lengthwise of the paper, and then again crosswise. This operation distributes the color evenly and leaves a good finish, varying slightly according to the work being done.

For all satin finished or glossed papers a second grounding is necessary. The first grounding, to adhere properly to the paper, requires an amount of glue which would render it too brittle to take a good polish, so a second coat is given, which carries a good deal more fine clay in a solution especially prepared to give a high polish. This operation is effected in a department not shown in our illustrations. It is done entirely on brushing machines, which work very rapidly, a cylinder about two feet in diameter revolving against smaller cylinders on its circumference, and the paper passing over one and under another until each portion of its surface has been vigorously brushed under six or eight cylinders.

All of the above work is preliminary to the printing proper, which is shown in the large view in the center of the page. For this purpose there are several large and small machines, the largest standing about fourteen feet high, and fitted to print twelve colors, but all working on the same principle. Each of these machines has a large drum in the middle, around which passes the paper, and, set at exactly the proper distances around its under side, are small rollers on which are the designs to be printed, each different color or shade being represented by a separate roller. It would hardly be proper to call these rollers or drums impression cylinders, in the sense in which printers use that term, for they bear very gently on the paper. The large drum is covered with a thick band of rubber, and is so light that it can easily be lifted away from the rollers carrying the design, as is always done in getting the press ready for work. It is, of course, absolutely necessary that the different colors should each come in their proper place, and so the small design rollers are all run by one large cog wheel, into which they are all geared. The color is taken up on cloth, in the same way as for the grounding, from little troughs or fountains near each of the design rollers, but it is pressed directly against the latter from the cloth itself as the rollers revolve, and each separate color is printed in succession as the large drum moves around.

Perhaps one of the most interesting details connected with the printing is the method of drying. Considerable time is required to thoroughly dry these heavy bodied pure water colors, and to do this work quickly and effectually the end of the paper first coming from the press is taken up and carried along by an endless belt, at nearly the height of the ceiling, and for a distance of some fifteen feet; the middle portion will then sag down, when a wooden slat is dropped on buttons on this belt, and taking the paper as it is coming from the press, carries it along and upward from that point, making a loop, for each fourteen or fifteen feet of the roll as it comes out. These slats carrying the loops of freshly printed paper are being constantly pushed forward on overhead railways which extend the whole length of the room, and underneath these railways are lines of steam pipe, each floor having special ventilators to carry off the moisture. At the end of the room there is an ingenious automatic arrangement by which the overhead railway carries the paper around a turn and back over a line parallel to that on which it came from the press, and so it continues to travel back and forth until thoroughly dry.

In making the bronzed papers, or those which have more or less of their patterns in silver and gold, the drying of the other colors must be effected before the bronzing. The size which is to carry the bronze is made especially for this purpose, and, when the colors which have been printed are entirely dry, the size, printed also at the same operation, is just in the proper condition to take and firmly hold the bronze. This is put on in a box-like machine with many brushes, into which the paper passes continuously from the press, after it has gone through its journey over the steam pipes on the overhead railroad.

Where embossed papers are wanted, in any style, the otherwise finished paper is simply run under a steel roller, of the desired surface, whereby it is pressed against a hard packing to give the required effect.

From the bronzing press, as from all the others, the paper proceeds, in the same manner as before, to the small machines for rolling, operated by girls, the work of which is shown in one of our pictures. Attached to each printing press is a gauge which indicates how many rolls are run, and makes a slight cut on the paper at the exact length required for each roll. The end of the paper being fed to the roller, it quickly turns until stopped by the operator at each of these cuts or marks, when a knife cuts it off, the roll is removed, and another roll started. This is the final operation of the manufacture. As the loops of paper are pulled out in the rolling, the slats which have suspended then drop at a certain point, to be gathered up and taken back to the presses.

One of the most important departments of the work, however, and the one which comes first in all the higher grades of goods, is the making of the designs for new patterns and styles. Old patterns are, nowadays, entirely unsalable, and the rule is that each year's patterns must be entirely new and distinct from those of the preceding season. So much so is this the case that the blocks are not saved, on the supposition that some old pattern might again become fashionable. It will be readily seen that this condition imposes upon manufacturers who have to constantly supply large lines of new and attractive patterns a task of no small magnitude. Messrs. Christy, Shepherd & Garrett have always stood in the front rank in their trade in this respect. They have artists regularly in their employment the year round, and also receive many patterns for competition from Europe as well as at home, and from the large number thus collected make selections of those they deem most meritorious. The artist makes the pattern and colors it as he deems most appropriate; but of any pattern they decide to use they make a great many different styles, by using different grounds with different combinations of colors, bronzes, etc., so that from one pattern sometimes as many as forty different styles are made.

From the designer's hands the pattern, after it has been accepted by the firm, goes to the block-cutting department shown in one of our engravings. Here it is drawn in outline on cylinders of wood carefully prepared to be of the exact size, and as many drawings made on different cylinders as there are to be colors in the pattern. The workman takes one of these cylinders and drives, in the line of the outline, little strips or pieces of brass, or it may be bits of brass wire, if a row of dots is wanted, or brass otherwise shaped to make a variety of small figures. A wire-drawing machine, with an assortment of dies, is kept to make many of the shapes wanted. When a large place is to be filled in to be printed in one color of which this brass work may form the outline, as a leaf, the center of a flower, etc., this space is filled with felt, firmly packed in. This brass and felt work, giving a perfect engraving on the circumference of the cylinder of all there is of one color to be worked in a pattern, stands up nearly a quarter of an inch from the wood; but that its surface may be entirely even and true, the face of the brass work is turned down under a file, and the whole is finally finished under an emery wheel.

Notwithstanding that, in nearly all of the operations of this establishment, the machinery works almost automatically, the firm employ during the busy months about 200 hands. The premises they occupy include a building 350 by 100 feet, and five stories high, besides several detached buildings in the rear. Their goods are exported to some extent to Europe, Australia, and South America, and have a large sale in every part of the United States; so that, although their facilities would seem to be so ample, they are frequently troubled to get the goods ready as fast as they are ordered. The total production last year amounted to about 6,000,000 rolls. The firm is one of the oldest, if not the oldest, in the country, having been established in 1836 by the late Thomas Christy, who died in 1874.

THE DEMAND FOR HEAVY HORSES.

The Factory and Farm states a fact which we have observed to exist in this city for some time past, *i. e.*, an increase in the number of large horses used on trucks and heavy business wagons. During the past fifteen years, the writer remarks, there has been a great change in the demand for horses in this country. Formerly nearly every one bred in relation to speed and endurance. Now a large proportion of farmers breed with a view to increasing size and strength. This change is not the result of caprice. There has been a steady, increasing demand for heavy horses, and a corresponding falling off in the demand for light ones. Fashion has had little to do in the matter. Heavy horses are wanted because they supply an existing want. From present appearances it will be many years before the supply of heavy horses will equal the demand. The country is now well supplied with horses. At no time in its history, perhaps, were there as many horses to a given number of inhabitants as at present. Small work horses are low, but heavy draught horses continue to be high.

The importation of Clydesdale and Percheron-Norman horses increases every year. The first that were brought over were regarded as very uncertain ventures. At present they are of no doubtful value. The importers of horses from France and Scotland have suffered none of the reverses of the importers of short-horn cattle. With rare exceptions they have become rich. From present appearances we shall soon be sending Clydesdales to Scotland and England, and Normans to France and Belgium. The value of heavy draught horses was recognized in the Old World before it was in the New. Now that their worth is appreciated here, all persons having teaming to do seem anxious to procure them.

Large horses are less liable to injuries from the swinging of the poles of wagons than small ones. Their bones are firmer, and they are commonly more hardy. Large horses are more economical as respects harness, stall room, feed, and work required to take care of them. In all the countries of eastern Europe heavy horses have taken the place of light ones in general farming operations. That American farmers will soon generally employ heavy horses in field work seems certain.

Dangers of Elevator Cables.

To the Editor of the Scientific American:

I am informed that the superintendent of a well known hotel and apartment house, near Union square, this city, in order to learn what effect the continued bending and unbending of the wire elevator cable causes by passing over the pulleys and around the drum, detached the cable and, to his astonishment, found it actually rotten. In bending it twice across his knee it broke. This cable had been in use only two years. If this constant bending and unbending the cable causes such a disintegration, should it not be more widely known, that examinations may be made and possible disasters prevented? SAMUEL SWAN, M.D.

13 West 38th St., New York.

[In view of the facts herein stated, we hope that the proprietors of elevators everywhere will cause frequent examination of their lifting ropes to be made. We think that the rope above mentioned must have been composed of extremely poor stuff. It is well known that properly made wire rope will stand the bending of elevator service better than any other known material and will last many years. If it has not been done already, it would be an interesting investigation to determine, by special experiment, the average life of such steel wire ropes as are commonly used in elevators. Mr. J. Burkett Webb, C.E., one of our correspondents, writing from Berlin, gives an account of recent testing experiments that he there witnessed, in one of which a steel rod fifteen inches long and one inch diameter had been bent over twenty millions of times, and was expected to stand some millions of bends more.

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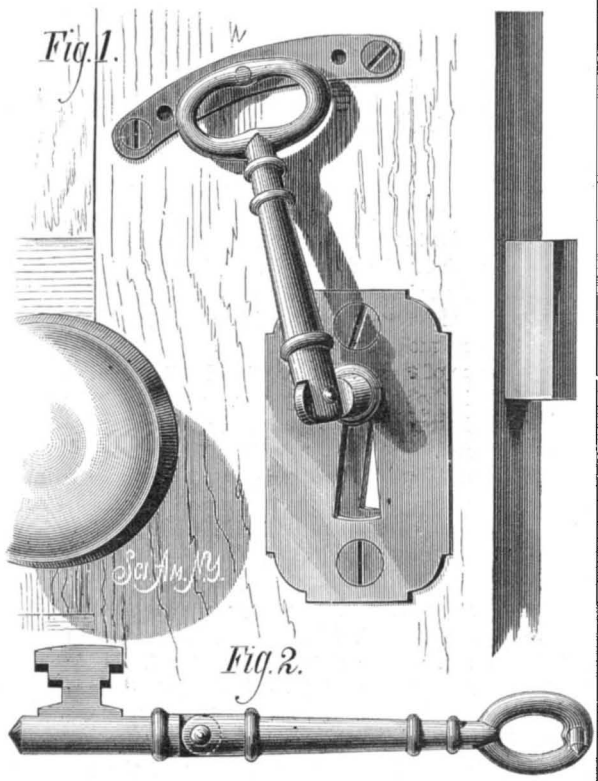
THE HOLLAND HYDROCARBON RETORT.

The accompanying illustrations will give a good idea of what the inventor claims for a method of producing heat and illuminating gas, which has attracted a good deal of attention within a few months past. As shown in an experimental way at No. 18 Vesey street, in this city, at the rooms of the company now developing the patents, the New York Heat, Light, and Power Company, it would seem that there could not be a more simple and effective process by which to obtain heat and light for household use, without any danger from explosion, at a very small cost, and without many of the annoyances at present experienced.

The stove shown in the sketch is an ordinary pattern of a small cook stove, with one corner at the top drawn to give an interior view. The fire pot is about a foot square, and here sets a small retort, of such size that its capacity would probably be about equal to that of a quart measure. Into this retort, which is divided into two chambers, naphtha and water are made to flow by a gentle pressure, the water into the left hand chamber and the oil into the one at the right. A fire being made in a sort of cup under the retort, by burning a spoonful or so of naphtha there for two or three minutes, the naphtha is admitted to one chamber of the retort, and the water to the other, the flow in this instance, and for stoves of this capacity, being stated as only a drop at a time, at about the rate of the beating of the pulse. The naphtha is immediately changed into gas and the water into superheated steam, when the gas passes out through one of the pipes shown at the top, and is carried down under the center of the bottom of the retort; the steam passes out from the other pipe, and is carried to the bottom of the retort, the termination of the pipe being a circle of about two and a half inches diameter, which surrounds the button from which the naphtha gas is discharged. This circle of steam pipe is pierced with small holes on the inner side, so that, combustion being set up, the superheated steam is discharged directly into the flame of the naphtha gas. And now we have, on a consumption of fuel given as almost infinitesimal, a fierce fire, the flame of which nearly fills the fire pot, and the heat being sufficient for all ordinary uses, while the combustion is so perfect that there is no perceptible smoke or smell, and the firebrick lining of the fire pot has not even been discolored. The flow of oil and water may be readily increased or decreased, as more or less heat is desired, so that the temperature of the stove can be nicely and almost instantaneously adjusted for the work in hand, but the supply pipes are so fitted internally with wire gauze that no excessive flow of oil can be set up, which, indeed, it is claimed, would not be possible on account of the pressure that would thereby be caused from the gas inside the retort. There is, of course, no necessity for a draught for this fire, which will burn equally well in all kinds of weather, and the only need of a stove pipe or chimney is in the burning of the small quantity of oil required under the retort to set up the initial heat.

The retort shown in the fire pot of the stove is separately illustrated, and there is also to the left, at the bottom of the picture, a sketch of another retort, in which are the same features as before described, with the addition of another chamber for making gas. The naphtha is supplied and its flow regulated in the same way, but instead of passing out to be consumed under the retort, it is made to go through pipes which lie against its side, whereby it is heated to make it less volatile and more of a fixed gas. From here it is conveyed through a box with iron filings, in order to separate from it any fluid naphtha, and thence to a small receiver, on the same principle as those ordinarily used. In this way the gas necessary for lighting a house may be made at the same time and by the same fire as is used in the cooking or for warming. The gas with which the company light their offices, as one of the proofs of the practical success of their process, where any one can see all the operations, is certainly very pure and bright, and its combustion seems to be absolutely perfect.

For the purposes of an open fire in a fireplace, the same form of combustion is adopted as in the stove for making the heat, but in addition thereto the gas made by this process is conveyed into hollow cylinders, piled up to represent a tier of logs, and from regular openings in these the gas issues, so that, when the fire is started, a regular apron of flame passes backward and upward over their surfaces. It takes but a few minutes in this way to "light a fire," which, in starting, burns up somewhat like cannel coal, and so much gas is used that we should suppose an ordinary room with such a fire would need no other light. It certainly would "not pay" to have such a fire if one had to count it in his gas bills, but the company claim that they make the gas so cheap that the expense of even such liberal use of it amounts to almost nothing, and the gas itself is so pure that no smoke, soot, or smell is made.



JOHNSON'S KEY FASTENER.

To show the merits of these processes the company have fitted up their offices in Vesey street so that two small tanks, of a capacity of perhaps one barrel each, one for water and the other for naphtha, are fixed close up to the ceiling, whereby they obtain a head of some twelve or fifteen feet on the naphtha and water in the pipes where they enter the retorts. They also have two small gas receivers of a total capacity of something like 500 feet, the whole apparatus being designed to show the practical application of these patents to household uses in heating and illuminating.

In addition to the above, however, and that which the company believe to be the most important field for their patents, they are endeavoring to perfect and develop the application of this method of obtaining heat to locomotive uses. With this end in view they have already made some experiments in the construction of motors for street cars, and have actually adapted a locomotive and run a train therewith on the Long Island Railroad. They propose to use steam in the same way as other engines, but the different manner of obtaining the heat requires a radically different construction, the details of which they have not yet practically succeeded in working out. Should they do all they promise and expect to accomplish in this direction, the future locomotive will be one that can be run at one-tenth the cost of those of the present style in the way of fuel, and will give out neither smoke, cinders, nor offensive gases.

The first of the patents relative to these processes was taken out by Dr. C. Holland, of Chicago, in 1877, and the last one during the present year, there being ten patents altogether. The New York Heat, Light, and Power Company own the patents for New York, New England, and the South. The inventor's claim is, in the main, that the attainment of these marvelous results is due principally to the dissociation of water in its form of superheated steam, and the total consumption of both its gases by the free access of outside air, under the conditions in which the burning naphtha gas is brought into contact with the steam under the retort.

SIMPLE KEY FASTENER.

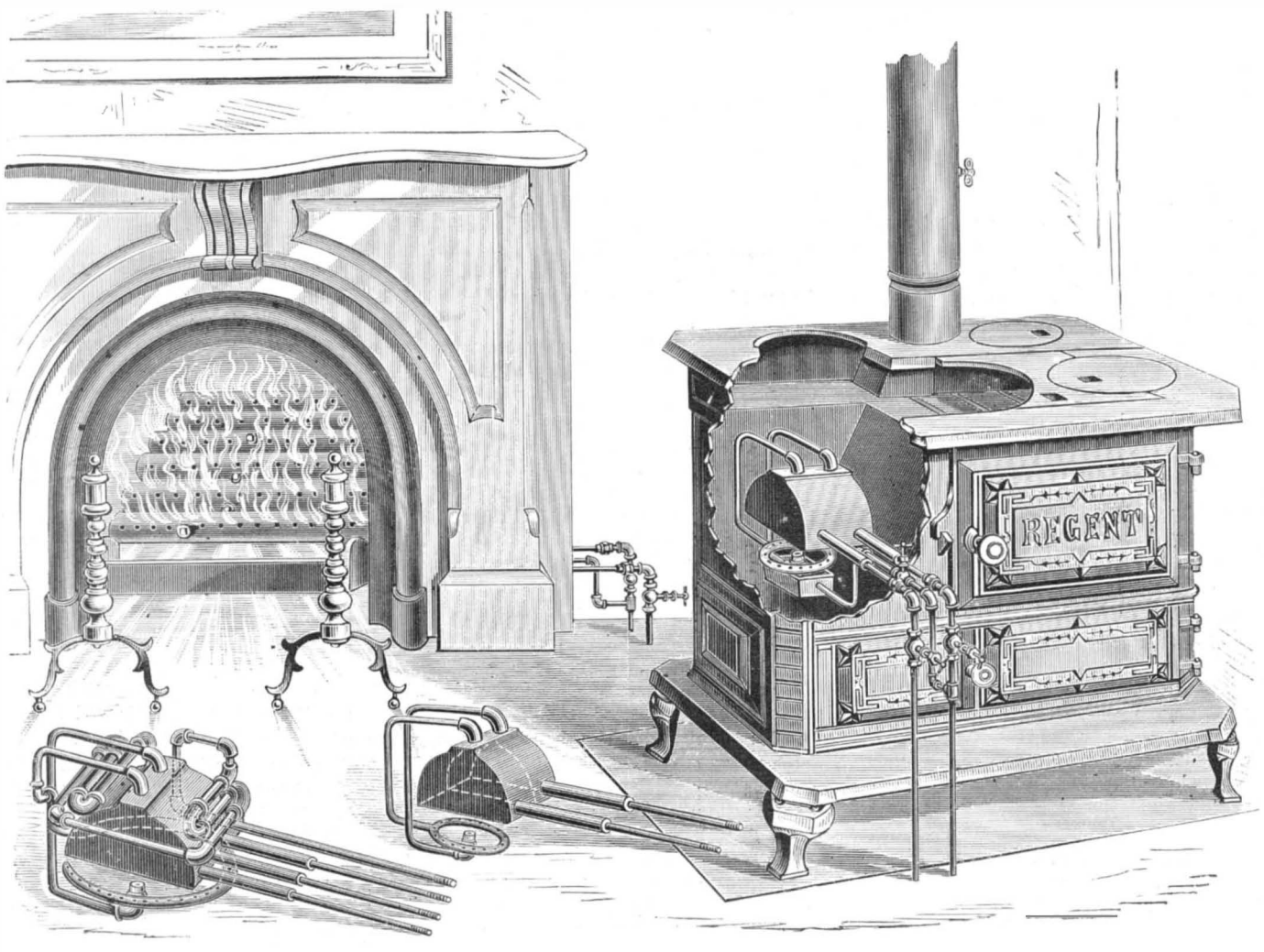
The engraving shows a very simple device for preventing locks from being burglarized. The lock may be of any construction; the invention relates to the key, the shank of which is jointed near the face of the door, and provided at or near its outer end with a stud, which enters a curved perforated plate attached to the door. The plate has a series of holes into any one of which the stud on the key may be inserted. This device effectually prevents turning the key from the outside by forceps or other instrument, and affords a sense of safety which is not felt when the key is left loose in the lock.

This useful invention was recently patented by Mr. Lenson Johnson, of Vincennes, Ind., who will furnish further information if desired.

HATCHING SPANISH MACKEREL.—A remarkable achievement in hatching deep sea fish is reported by Mr. E. G. Blackford, on the authority of a member of the United States Fish Commission. After many failures the eggs of the Spanish mackerel have at last been successfully hatched by one of the experts in the employ of the Commission.

Benjamin Nadault de Buffon, French Engineer.

Professor Benjamin Nadault de Buffon, a grand nephew of the celebrated naturalist, died in France in June, aged 76 years. He was born at Montbard, (Cote d'Or), February 2, 1804; graduated from the Ecole Polytechnique in 1826; entered the government service as engineer of highways and bridges, rose to be chief engineer and professor of agricultural hydraulics at the imperial school of his department of engineering. He was a great authority on irrigation, and was widely known as the projector of the scheme for reclaiming the Crau d'Arles plain by irrigation from the Rhone. He was long in charge of the Division of Hydraulics at the Ministry of Public Works, was intrusted with important commissions for the prevention of inundations, wrote several volumes on engineering subjects, and was promoted to the high grade of Officer of the Legion of Honor in 1864.



THE HOLLAND HYDROCARBON RETORT.

Not a Sea Serpent.

The dead monster seen by Capt. Ingalls off the coast of Maine, and noticed in the SCIENTIFIC AMERICAN a short time since, drifted ashore at Seguin, Maine, and proved to be a basking shark (*S. maximus*, or *S. elephas*). This is not the first time that the creature has been mistaken for a sea serpent, owing to its slender body and great length. It sometimes attains a

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length of sixty or seventy feet. Its home is in the northern seas, but sometimes it has been seen as far south as Maine. Its natural history does not appear to have been well worked out, though it is hunted, to some extent, for its liver oil. It is inoffensive in its habits, probably herbivorous, and exhibits none of the characteristics of the shark family.

AGRICULTURAL INVENTIONS.

Mr. Jacob Anderes, of Pacific, Mo., has patented a hand seed planter, to the base plate of which are attached spring-closed spouts and a seed box provided with discharge holes. The planter drops corn in three places in the hill.

Mr. Isaiah H. Reiner, of Line Lexington, Pa., has invented a harrow which can be readily transformed into a sled to facilitate its transportation from place to place, and which can also be used to carry grain and agricultural implements to and from the place where they are used.

Mr. David B. Eberly, of Boswell, Ind., has patented an improved harrow. It is so constructed as to cut in pieces lumps and sods and pulverize the soil. It will adapt itself to uneven ground, and can be adjusted wider or narrower as required.

Mr. T. C. Baxter, of Glenwood, Kan., has invented a potato fork, which is more efficient than a plow or an ordinary hoe or fork in removing potatoes from the hill. To the rear of a fork of ordinary construction is attached a foot piece, that is bent outward and upward and secured upon the handle. A front handle is in like manner secured to fork and handle. When used by two persons the fork is placed back of the hill and thrust beneath the potatoes by their combined action; then it is pulled and pushed forward and upward at the same time, lifting and dragging out all the potatoes from the hill. As the potatoes remain upon the fork, a shake or two given to it will separate them from the earth, which will fall between the tines.

A spring harrow tooth so constructed that it may be secured adjustably to the bars of the harrow frame, will be firmly and securely held, can be readily adjusted, and will economize steel in its manufacture, has been patented by Mr. Arthur P. Sprague, of Kalamazoo, Mich.

Pearls in New Zealand.

The Auckland *Evening Star* reports the discovery of pearls in Oakley creek, New Zealand. While passing along the bank of the creek, Mr. Benjamin Gittos, an old resident of the district, observed a peculiar and, to him, new shell fish in the sand. A little search disclosed a large number of them of various sizes. The inner coating of the shell was found to be mother-of-pearl of fine quality, and in several of the larger shells he found loose pearls. The pearls are described as unusual in form and color, not perfectly round, but far more brilliant than ordinary pearls.

THE MOUSE-EATING SPIDER AT THE ZOO.

This formidable insect is one of the latest arrivals at the Zoological Gardens, Regent's Park. It comes from Bahia, a maritime province of Brazil, and is common in the South American forests. Its body, which is covered with hair, is three inches in length, and its legs are in proportion; so that, when extended, it is about as big as a cheese plate. It feeds on mice and small birds, which it catches by springing suddenly upon them from ambush in the hollow of a tree or beneath a large leaf. At the Zoo it is fed chiefly on a large kind of cockroach (twice as big as those often met with in our kitchens), which comes to England in the cages in which certain animals are imported, and have hitherto been a great nuisance to the managers of the gardens.—*Graphic.*

JAPANESE ART.

The engraving on this page will be recognized by every one as an example of Japanese art. This vase stands about four feet in height. It is of bronze, a favorite material with the Japanese metal workers, who are certainly unsurpassed by any people in the world for originality of design and skill in execution. This is an excellent specimen of their peculiar method. In the grotesques at the base and in the relief ornamentation on the sides we see that peculiar exaggeration and distortion of natural objects which many people prefer to the conventionalism obtaining with Europe-

JAPANESE BRONZE VASE.

pean artists. Here, too, in the elaboration of minute designs on the collars and the rim and in the superbly executed handles, we see the evidence of a patient, painstaking labor such as only oriental workmen practice.

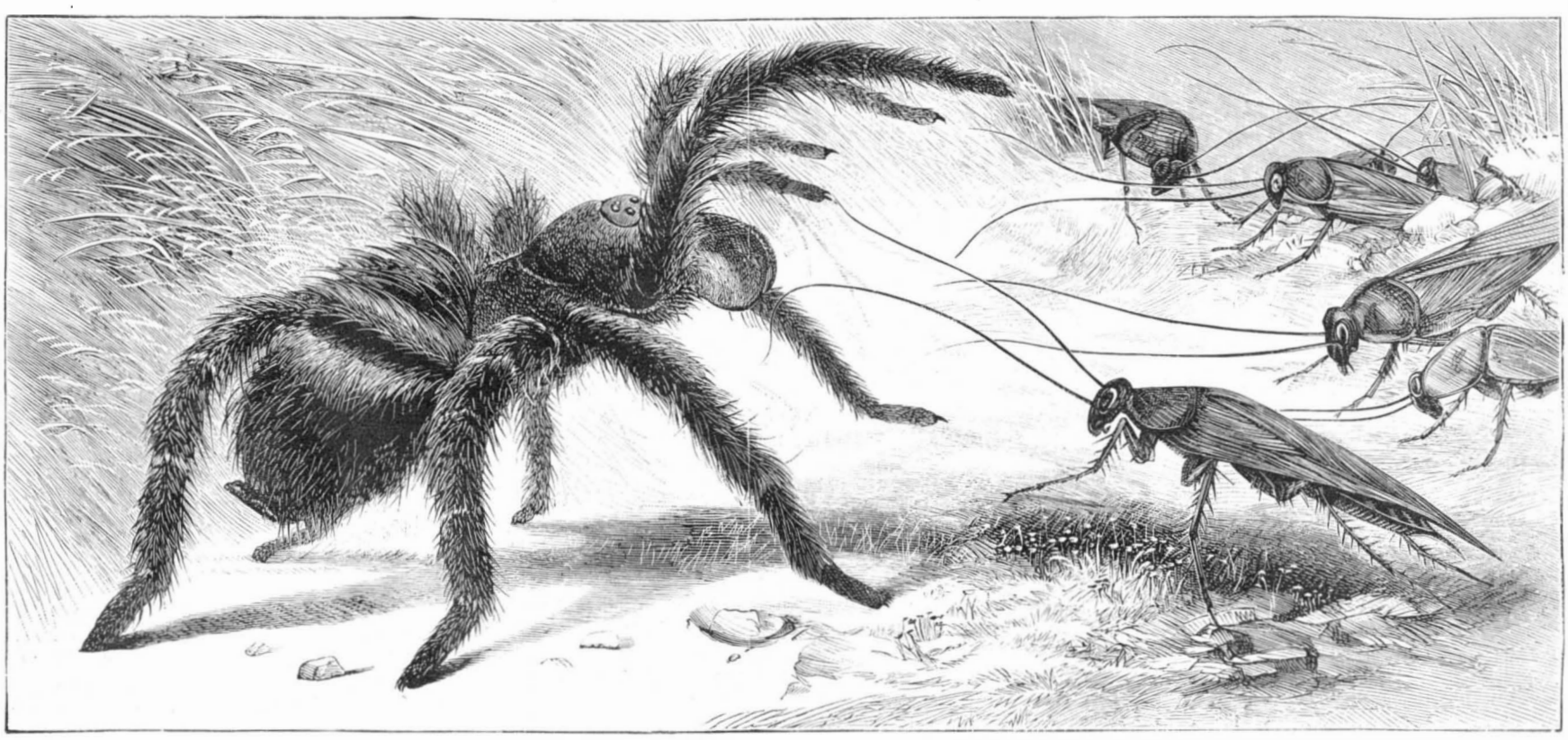
Large Cuttle Fish.

All exact information about gigantic Cephalopoda is of interest not only as showing what immense marine creatures do exist, but as preparing us for the possibility of meeting with still greater. Prof. Verrill has collected a great deal of accurate and recent information as to the North American species, of which he publishes a list in the April number of the *American Journal of Science*, from which we cull the following: On November 2, 1878, a fisherman was out in a boat with two other men near Leith Bay Copper Mine, Notre Dame Bay, when they observed some bulky object not far from shore, which they approached, thinking it might be part of a wreck. To their horror they found themselves close to a large fish having big glassy eyes. It was making desperate efforts to escape, and was churning the water into foam by the motion of its immense arms and tails. Finding it partially disabled, they plucked up courage and threw the boat's grapnel, which sank into its soft body. By means of the stout rope attached to the grapnel and tied to a tree the fish was prevented going out with the tide; its struggles were terrific, as, in a dying agony, it flung its great arms about. At length it became exhausted, and as the water receded it expired. Its body, from the beak of the mouth to the extremity of the tail, measured twenty feet, and one of the tentacles, or arms, measured thirty-five feet. This is the largest specimen yet measured of *Architeuthis princeps.* Prof. Verrill mentions eighteen species as now known on the northeastern coast of America.

NATURAL HISTORY NOTES.

A Monstrous Seaweed.—Of all marine algæ, the *Nereocystis* is most wonderful. Its stem occasionally attains a length of three hundred feet, though it is extremely slender even at the top, where it is surmounted by an enormous floating bladder six or seven feet long, which affords a favorite resting place to the sea otter. The account, indeed, is apparently so fabulous as given by Mertens in an interesting paper on the botany of the Russian possessions in America, that it could not be believed did it not depend upon unquestionable authority. The filiform stem (which is about as thick as pack thread) when two or three feet long, swells suddenly above into a globose bladder. From the top of this springs a tuft of germinate leaves, mostly rising on five petioles. These leaves are lanceolate and membranaceous, from one to two feet long, and two inches broad in the center. As the plant grows older, the stem increases enormously in length, but only slightly in thickness. The globose bladder swells into a turnip-shaped or retort-like cylinder, six feet long and four feet six inches or more in diameter, in the widest part, the lower extremity gradually passing into the stem. The leaves, which at first were marked with a few faint nerves, split in the direction of the latter, cover a large space by their entangled mass, and attain a length of twenty-seven feet or more. Where the plant grows in any quantity, the surface of the sea becomes impossible to boats, in consequence of the dense floating masses of vegetation. The stem is employed for fishing lines when dry, and the large cylinder is used as a siphon for draining water out of boats, in the same way that another seaweed—the *Ecklonia buccinalis*—is used frequently at the Cape.

Bees and Flowers.—A writer in the *Midland Naturalist* says: "Bees, when gathering honey, seem to me (and I make the remark after many observations) to confine themselves during any given excursion to flowers of the same family. Thus, when I have watched a bee or butterfly gathering honey from a rose I have found that when it next alights it is invariably on another rose, and on no other flower." To this the editor adds the following notes from Kerner: "Flying insects in their search for nectar frequently confine themselves during their rapid visitation of successive flowers to the blossoms of one and the same species. For example, in a meadow at Trins, in the Gschnitz Valley, I saw *Bombus montanus* visiting only the inconspicuous flowers of *Anthyllis alpestris*, whilst the numerous and far more striking nectar-bearing flowers of *Pedicularis Jacquini* and *P. incarnata* were passed over. Contrariwise in another place, in a meadow in the Padail Valley, I saw this same species of bee buzzing from one *Pedicularis* flower to another, whilst passing over the intermixed *Anthyllis alpes-*



THE GIGANTIC MOUSE-EATING SPIDER AT THE ZOOLOGICAL GARDENS LONDON.—(Natural Size.)

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tris." On this passage, Dr. Ogle, the English editor of Kerner's work, remarks that a similar observation as to the habits of bees was made by Aristotle. "A bee," he says, "on any one expedition does not pass from one kind of plant to another, but confines itself to a single species, for instance to violets, and does not change until it has first returned to the hive.

Hybrid Fishes.—According to Mr. R. B. Roosevelt, the fish hatching Commission have raised hybrids between the following species of fishes: Salmon trout with whitefish; salmon trout with brook trout;brook trout with fresh water herring, with California salmon, and with the California mountain trout; shad with striped bass and herring. Of these crosses there are the young, now in the hatching house,of the salmon trout brook trout, brook trout California salmon, and brook trout California brook trout. It is observable of all hybrids that they are usually more shy and wild than either of their parents, and that in appearance they generally favor their larger parent. The cross between the brook trout and California salmon, and the salmon trout and brook trout bid fair to be fine fish. Those now in the hatchery are eight inches long. It is to be hoped that further careful experiments may be made to ascertain whether these hybrids are fertile and capable of producing fertile offspring.

The Mullein.—The common mullein, regarded as but a common coarse weed in this country, and so common in fields as to often prove a nuisance, is cultivated in England for its beauty. A writer in the *Gardeners' Chronicle* says that it "is well worth the attention of both amateur and professional gardeners." It seems that it is known in England by the common name of "Aaron's Rod." "There are two reasons," says this writer, "why it should be called by this name: first, the Romans dipped the stems in tallow, and burnt them at funerals. Secondly, the simple spike is long, cylindrical, and on it is a quantity of densely packed, very large, handsome golden-yellow flowers. The stem is five feet high. The flowers, when dried in the sun, give out a fatty matter, which is used in Alsace as a cataplasm in hemorrhoidal complaints. Formerly the plant was called barbascum, from *barba*, meaning a beard, an allusion either to the shaggy nature of its foliage, or else to two of the five stamens, which are hairy.

Private Patents.

Secret processes in manufacture are not uncommon now and here, notwithstanding the reasonable cost of a patent and the facilities for obtaining it. In England, where the cost and trouble of procuring a patent is much greater than here, these secret processes and receipts are very common, and the visitor to manufacturing establishments is frequently interdicted from a thorough exploration. The practice is a perfectly proper one, as an inventor as much owns the product of his brain and skill as the money he has earned; but there is always more or less risk attending the attempt to keep secret any profitable knowledge. If only one man possesses the secret, it is liable to be lost by his sudden death, to be possessed again only by a re-discovery. And although a certain prominent public lecturer may have attached undue importance to what he calls "the lost arts," it is undoubtedly true that there have been lost to the world really valuable facts in mechanics and chemistry and other arts and sciences by these attempts at secreting facts.

But there are patents in use which belie the term. Anything that is patent is "known" or "seen," the terms being synonymous. Yet there are methods of manufacture, compositions of materials, and machines for operation which have been patented and yet have never become known to the public. In some of these instances this withholding of public information is designed and intentional, the holders of the patents working it for their own profit, and believing that to be better for them than sharing it and receiving a royalty. It must be acknowledged that these are wiser than those who depend for their monopoly on their confidence in human nature—in human fealty—and run the risk of losing their advantage by death or unfaithfulness; for at the worst those who would share in the profits of the patented article may be compelled to pay fairly for it.

The number of these private patents which are held and used would surprise one who did not have good opportunities to ascertain the facts. And some of them are wonders of ingenuity and skill. One noted only a few days ago is a case in point. Among the productions of a busy concern recently inspected was that of drawer-knobs of wood. The extremely low price at which these knobs were sold was a surprise until the process of manufacture was witnessed; then it was apparent that the trifling price asked allowed a handsome margin for profit. A boy sat at a machine placing bored cubes of wood on a projecting pin that presented itself almost as fast as he could conveniently handle the blocks. Yet, every time he placed a block on the pin, a finished knob was thrown off, requiring only the insertion of a plug with which to secure the knob to the drawer, and varnishing to be ready to pack for the market. When the machine is prepared with the proper cutters it will turn almost any form of knob required, and being fed with the material in blocks it is absolutely automatic. "Only two of these machines were made," said the superintendent. "Where is the other?" was asked. "Out in the barn," was the answer. Here was a combination of self-acting tools that had been patented, and yet not used except in the concern where it originated, and so prolific was it in product that a second machine had been found unnecessary.

This is but a single instance of the use of an unknown though patented article. Some of the work done and some of the modes of work and action of these machines are very curious. It would quite astonish the reader if it was proper to describe the action of machinery seen in operation recently at a bolt-making concern. Some of the processes in the production of "bright goods"—those from stiff polished wire—practiced in certain concerns, and some of the operations in sheet metals, although patented, are unknown to "the trade" generally.

There is another class of unknown patents which are very like undeveloped mines of legally enjoined enterprises, of no profit to the owners and of no use to the world. Some of these patents lie useless because the holders have not the wisdom, energy, or money to push them. There are men who are keen enough to see the failures and note the shortcomings of others and cover their unprotected openings, yet who cannot understand their own advantage. They can invent and discover, perfect and improve, but they hardly know what to do with their creation or improvement. To be of any profit to them it should be made of use to others; but they neglect proper means of publicity, and eventually the invention or improvement is forgotten until some "live" man brings it out in different form, but perhaps no better shape, and claims the honors and reaps the profits. It is then, if ever, these slow coaches heave in sight. Then they begin to bluster about prior claims and prior discovery. But generally the enterprising reinventor takes all the honors, gives his own name to the invention, and gets the emoluments that attend on success.—*Boston Journal of Commerce.*

Submarine Topography.

The coast survey steamer Blake, Commander J. R. Bartlett, United States Navy, recently returned from a cruise taking soundings, serial temperatures, etc., in the course of the Gulf Stream, under instructions from C. P. Patterson, Superintendent of the Coast aud Geodetic Survey, has brought some very interesting data in regard to the depths of the western portion of the Caribbean Sea. The depths and temperatures obtained last year in the "Windward Passage" between Cuba and St. Domingo were verified, and a few hauls of the dredge taken directly on the ridge in this passage. The data obtained render it very probable that a large portion of the supply for the Gulf Stream passes through this passage, and that the current extends in it to the depth of 800 fathoms. A few lines of soundings with serial temperatures were run from Jamaica to Honduras Bank, via Pedro and Rosalind Banks, and it was found that the temperature of 39½°, obtained at all depths below 700 fathoms in the Gulf of Mexico and the Western Caribbean, could not enter through this portion of the sea. But the temperature at the depth of 800 fathoms on the ridge in the "Windward Passage," between Cuba and Hayti, was found to agree with the normal temperature of the Caribbean and Gulf of Mexico, viz., 39½°. Soundings were taken between Hayti and Jamaica, developing a general depth between these islands not exceeding 800 fathoms, except where broken by a remarkably deep channel connecting the waters of the main Caribbean south of St. Domingo with those north of Jamaica. This channel runs close to Hayti with a greatest depth of 1,200 fathoms, and a general depth of 1,000 fathoms. Its course is northerly along the western end of Hayti, where it does not exceed a width of five or six miles; thence westerly, south of Navassa Island, with a tongue to the northward between Navassa and Formigas Bank, and another to the westward between Formigas Bank and Jamaica. A line of soundings was run from St. Iago de Cuba to the east end of Jamaica, where a depth of 3,000 fathoms was found twenty-five miles south of Cuba. This deep place was found by subsequent soundings to be the eastern end of an immense deep valley extending from between Cuba and Jamaica to the westward, south to the Cayman Islands, well up into the bay of Honduras. The Cayman Islands and the Misteriosa Bank were found to be summits of mountains belonging to a submarine extension (exceedingly steep on its southern slope) of the range running along the southeastern side of Cuba. This deep valley is quite narrow at its eastern end, but widens between the western end of Jamaica and Cape Cruz, where the soundings were 3,000 fathoms within fifteen miles of Cuba, and 2,800 fathoms within twenty-five miles of Jamaica. Near Grand Cayman the valley narrows again, but within twenty miles of this island a depth was found of 3,428 fathoms. The deep water was carried as far as a line between Misteriosa Bank and Swan Islands, with 3,010 fathoms within fifteen miles of the latter. On a line between Misteriosa Bank and Bonacca Island there was a general depth of 2,700 fathoms, and a depth of over 2,000 fathoms extended well into the Gulf of Honduras. Between Misteriosa Bank and Chinchorro Bank the soundings were regular at 2,500 fathoms. North of Misteriosa and Grand Cayman to the Isle of Pines and Cape St. Antonio the soundings were generally 2,500 fathoms. The serial temperatures agree, in relation to depth, with those obtained in the Gulf of Mexico by Lieutenant Commander Sigsbee, and in the Eastern Caribbean by Commander Bartlett; decreasing from the surface to 39½° at 700 fathoms or less, and constant at that temperature for all depths below 700 fathoms. At depths greater than 600 or 700 fathoms the bottom was always found to be calcareous ooze composed of pteropod shells with small particles of coral. These pteropod shells, as noted in previous expeditions by different nations, appear to be an important factor in the determination of the movements of great bodies of sea water. The ridge at the "Windward Passage" is bare coral rock, and on the south side the pteropod shells were found to be much more numerous than to the northward of the ridge.

Soundings and serial temperatures being the special objects of the cruise, dredgings were only incidentally attempted, for the purpose of reconnoitering, as it were, the ground; and it was found that the area passed over was not nearly so rich in animal life as that in which dredgings were made last year under the lee of the Windward Islands, at the eastward of the Caribbean Sea.

The development of the extraordinary submarine valley in the Western Caribbean Sea is a matter of great interest, considered as a physical feature. This valley extends in length 700 statute miles from between Jamaica and Cuba nearly to the head of the Bay of Honduras, with an average breadth of eighty miles. Curving around between Misteriosa Bank and Yucatan, and running along between Cuba and the ridge of the Caymans for a distance of 430 miles, with a breadth of 105 miles, it covers an area of over 85,000 square miles, having a depth nowhere less than 2,000 fathoms, except at two or three points (the summits of submarine mountains), with a greatest depth, twenty miles south of the Grand Cayman, of 3,428 fathoms; thus making the low island of Grand Cayman, scarcely twenty feet above the sea, the summit of a mountain 20,568 feet above the bottom of the submarine valley beside it—an altitude exceeding that of any mountain on the North American continent above the level of the sea, and giving an altitude to the highest summit of Blue Mountain, in Jamaica, above the bottom of the same valley, of nearly 29,000 feet—an altitude as great, probably, as that of the loftiest summit of the Himalayas above the level of the sea.

For the deepest portion of this great submarine valley, the Superintendent of the Coast and Geodetic Survey has adopted the name of "Bartlett Deep."—*N. Y. Herald.*

CAPT. DOBBINS'S SELF-RIGHTING LIFE BOAT.

Capt. D. P. Dobbins of the Life Saving Service reports the practical success of the life boat built on his plan, the construction and testing of which was provided for by Congress last spring. Capt. Dobbins reports as follows to Supt. Kimball:

"The self-righting surf boat authorized by letters of March 3 and 4, was completed and tested Thursday, June 17, by the keeper and crew of Life-Saving Station No. 6, under my personal supervision. The boat proves to be a perfect success. It will right instantly and carry her entire crew around with her when full of water as she is, on righting, and with her crew at their stations. She shows a side of over six inches out amidship, so she can be bailed readily. She is very stable or stiff under foot and in a seaway. It was quite difficult for the seven men to capsize her, full as much so as it is for the crew of the English self-bailing and righting life boats to capsize them. The prescribed beam of the boat made it difficult to secure the ready righting I claim for my own dimensions, but I have succeeded at the loss of a heavier boat than I designed for a practical surf boat. She will weigh not over 1,000 pounds, however, which is 600 pounds less than our ordinary surf boats weigh. She is roomy, stout, stanch, and strong, and pulls easily, and is a most beautiful sea boat."

This boat, which is not to be patented, dispenses with the heavy keel of the life boats now in use by the Service, and is "self-righting" by virtue of its model.

Walnut Timber from Arkansas.

The towboat Ida reached New Orleans, out of the Arkansas River, on June 8, with a walnut log raft of unusual proportions. Additional interest attaches itself to this raft on account of it being part of an order for 10,000,000 feet from a Bridgeport, Conn., sewing machine factory. The growing scarcity of this desirable wood in the Eastern States, and the demand by European furniture makers has developed distant sources of supply. The raft in question had been ninety days making the trip from the forests along the White and St. Francis rivers, in Arkansas, and in that time drift, five feet deep, had accumulated beneath the logs. Of these the raft contained 2,500, 2,000 being walnut and 500 cypress. The latter are used as buoys for the heavier timber. This log island measured 400 by 208 feet, and many of the walnut logs were over six feet in diameter. They were cut by a band of 200 Canadians who are adepts at working in hard timber, and can get out 500 logs per day under favorable circumstances. From New Orleans the logs go by rail to New England, this transportation being found to be just $2 per 1,000 less than by steamship. Col. S. M. Markel, of Missouri, has this contract, and has orders for walnut logs from Liverpool parties. The raft in question contained 600,000 feet, and is among the first shipments of the kind to the East.

A Sale of Fancy Cattle.

An important sale of short-horn cattle took place at Chicago the last day of June. The cattle were the property of Hon. M. H. Cochrane, of Compton, Canada, and Col. Le G. B. Cannon, of Burlington, Vermont. The Seventh and Eighth Duchesses of Hillhurst brought eight thousand dollars each. There were sold altogether thirty-two cows, averaging $995, and bringing in all $31,680. Eleven bulls were sold for $6,845, an average of $622.

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The Sense of Smell.

The sense of smell is composed of two parts—a physical and nervous. The Schneiderian mucous membrane is the physical portion; the first pair of olfactory nerves constitutes the nervous portion. The Schneiderian mucous membrane (named in honor of Schneider, who first demonstrated that the nasal secretions came from racimose glands in this membrane, and not from the brain, as was formerly supposed) lines the entire nasal cavities. The olfactory portion, with which we have to deal in the study of the sense of smell, is easily distinguished from the rest of the nasal passages; in man, the sheep, and the calf, it is yellow; in most other mammalia it is of a brownish tinge; it is softer and thicker than other portions of the nasal mucous membrane. In man the epithelium of the olfactory membrane is covered with vibrating cilia, which are absent in most quadrupeds; this difference of structure probably is one cause of the inferior acuteness of the sense of smell in man. The olfactory membrane is limited by a tolerably well defined outline to the superior and middle turbinated bones and the upper part of the septum nasi. This portion only is capable of receiving odorous impressions.

The olfactory nerve or ganglia has three roots, the exact origins of which have not been definitely made out; the external root, which is of white matter, has been traced to the corpus striatum and optic thalamus, anterior commissure, and some fibers to the convolutions of the island of Reil. The middle or gray root arises from the caruncula mammillaris in the anterior lobe. The inner root of white matter arises from the inner and back part of the anterior lobe, and is probably connected with the gyrus fornicatus. These coalesce and run forward to the cribriform plate of the ethmoid bone, where there is a bulbous enlargement, from which are sent down the showers of filaments going to the olfactory mucous membrane. These filaments divide and subdivide, forming microscopic plexuses in the substance of the olfactory membrane, and appear to terminate between the fusiform cells of that membrane. The olfactory membrane also receives filaments from the nasal branch of the fifth pair of nerves, and is in direct communication with the spheno-palatine ganglion of the sympathetic. It seems probable that the sense of smell is due to the solution of the emanations from bodies in the fluid secreted by the racimose glands of the olfactory membrane, and in this condition coming in contact with the terminal filaments of the olfactory nerves produces a molecular change, either chemical or physiological, which change, when transmitted to the brain, gives rise to the sensation. As a general rule the longer the olfactory membrane is exposed to a particular odor the longer its effects continue; and in some cases it may be perceived for quite a while after the odoriferous substance has been removed. A person once having perceived a certain scent, will sometimes recognize the same odor (even though he may have forgotten it) without anything causing an idea of it, save perhaps an irritation of the ganglion.

This ganglion is situated, according to Ferrier, in the temporo-sphenoidal convolutions, and is by him regarded as the psychological center of the sense of smell.—*Medical Bulletin.*

The Eating of Clay.

Among the extraordinary passions for eating uncommon things, says Prof. Johnson (Chemistry Common Life), is to be reckoned that which some tribes of people exhibit for eating earth or clay. For instance, in Western Africa, the negroes of Guinea have been long known to eat a yellowish earth, there called *Caouac*, the flavor or taste of which is very agreeable to them, and which is said to cause them no inconvenience. Some addict themselves so excessively to the use of it, that it becomes to them a kind of necessity to their lives—as arsenic does to the Syrian peasants, or opium to the Theriaki—and no punishment is sufficient to restrain them from the practice of consuming it. When the Guinea negroes used in former times to be carried as slaves to the West India islands, they were observed to continue the custom of eating clay; but the *caouac* of the American islands, or the substance which the poor negroes attempted in their new homes to substitute for the African earth, was found to injure the health of the slaves who ate it. The practice was therefore long ago forbidden, and has now probably died out in the West Indies.

In Martinique a species of red earth or yellowish tufa was still secretly sold in the markets in 1751; but the use of it has probably ceased in the French colonies also. In Eastern Asia a similar practice of eating earth prevails in various places. In the island of Java, between Sourabaya and Samarang, Labillardiere saw small square reddish cakes of earth sold in the villages for the purpose of being eaten. These were found by Ehrenberg to consist for the most part of the remains of microscopic animals and plants, which had lived and been deposited in fresh water. In Runjeet Valley, in the Sikkim Himalaya, a red clay occurs, which the natives chew as a cure for the goiter. The chemical nature of the substance has not been examined. In Northern Europe, especially in the remote parts of Sweden, a kind of earth known by the name of bread meal, is consumed in hundreds of cartloads, it is said, every year. In Finland a similar earth is commonly mixed with the bread. In both these cases the earth employed consists for the most part of the empty shells of minute infusorial animalcules, in which there cannot exist any ordinary nourishment. In North Germany, also, on various occasions, where famine or necessity urged it, a similar substance, under the name of mountain meal, has been used as a means of staying hunger. In South America, likewise, the eating of clay prevails among the native Indians on the banks of the Orinoco, and on the mountains of Bolivia and Peru. Humboldt states that the earth eaten by the Otomac Indians, on the Orinoco, is an unctuous, almost tasteless clay—true potter's earth—having a yellow-gray color, in consequence of the presence of oxide of iron. This they select with great care, and they are even able to distinguish the flavor of one kind of earth from that of another. At the periodical swelling of the river, which lasts from two to three months, and when all fishing is stopped, they devour immense quantities of earth. An Indian will eat from one-quarter of a pound to one pound and a quarter of this food daily. A similar practice prevails in the hill country of Bolivia and Peru. Dr. Weddell saw a species of gray colored clay exposed for sale in the markets of La Paz, on the Eastern Cordilleras, and which was called by the native name of *Pahsa*. The Indians, who are the only consumers of it, eat it in large quantities with the bitter potato of the country. They allow it to steep for a certain time in water, so as to form a kind of soup or gruel, and season it with salt. At Chiquisaca, the capital of the State, small pots made of an earth called *Chaco* are exposed for sale. These are eaten like chocolate. The eating of certain varieties of earth or clay may therefore be regarded as a very extended practice among native inhabitants of tropical regions of the globe. It serves, in some unknown way, to stay or allay hunger, stilling, probably, the pain or craving to which want of food gives rise. It enables the body to be sustained in comparative strength with smaller supplies of ordinary aliment than are usually necessary; and it can be eaten in moderate quantities, even for a length of time, without any sensible evil consequences. A fondness even is often acquired, so that at last it comes to be regarded and eaten as a dainty.

Botanical Notes.

Influence of Light on Size of Leaves.—M. Ch. Flahault, in the *Annales des Sciences*, brings forward additional observations to support his view that under equal conditions, the leaves of plants of the same species are larger in proportion as we go northwards, these relatively larger dimensions being due to the duration of light of relatively feeble intensity. In cases where the chlorophyl is formed in the absence of light it must be formed at the expense of the materials stored up in the tissues. The importance of these reservoirs of nutriment is still greater in the case of flowers. Thus, in the case of hyacinths, both blue and red. M. Flahault found no difference in the color of the flowers grown in the light or in the dark, the color being manufactured from the stores of material in the bulbs.

A Wonderful Tree.—Baron Ferd. Von Mueller says in his "Eucalyptographia," that one of the grandest trees of the globe, and one of the greatest wonders in the whole creation of plants, is the *Eucalyptus diversicolor*. Astounding records of the height of this tree have been given. The Messrs. Muir saw trees with stems 300 feet high up to the first branch, and Baron Von Mueller himself noticed many which approached to 400 feet in their total height. When closely growing the young trees may have a comparatively slender trunk, so much so that a tree 180 feet high may show a stem hardly more than a foot in diameter. In such a case the foliage, for want of space, is also only scantily developed, and the ramifications are but short in proportion to the tallness of the stems. In the mast-like straightness of the trunk and the smooth whiteness of its bark, this superb tree imitates completely the variety *regnans* of *E. amygdalina*, of Southeast Australia, with which also, and perhaps solely, it enters into rivalry as the tallest tree of the globe. Even the loftiest trees may not have been found out yet in the secluded humid forest valleys, in which *E. diversicolor*, like *E. amygdalina*, rejoices most and luxuriates to the greatest extent. But possibly in the 200 miles of uninterrupted length of *Sequoia* forests, a few years ago rendered known to exist in Southern California, mammoth trees of *Sequoia Wellingtonia* or *S. sempervirens* may occur, which possibly excel in stupendous height even the famous individual trees of the Calaveras grove.

Big Trees of the West.—Case's "Botanical Index" gives the following record of some large trees growing in Indiana: *Chestnut.*—In Jackson County there are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 23 feet in circumference 2 feet above the ground, and the height to the first limb is 70 feet. *Sassafras.*—This tree attains a remarkable size on the Lower Wabash. One of these, one mile and a half west of Springfield, is fully 3 feet in diameter, and for more than 60 feet clear of limbs and knots. Its height in full is 85 feet. *Catalpa.*—In this same region and along the Wabash the catalpa grows slender and tall, and in great abundance. It is used for both fence rails and posts, and for durability stands next to the black locust. *Sycamore.*—The giant tree of Indiana, in all probability, is a sycamore in the White River bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than 5 feet in diameter. The tree is not quite round, but still it is quite regular.

Botanical Gardens.—A paper on the botanical enterprises of the empire was read, May 11, to the Colonial Institute by Mr. Thiselton Dyer, Assistant Director of Kew Gardens. The lecturer gave a history of botanical gardens, which date from the middle of the sixteenth century, when Alfonso d'Este, Duke of Ferrara, the patron of Tasso, set the fashion of making collections of foreign plants and flowers. The earliest public botanic garden was founded by Cosmo de' Medici, in 1544, for the University of Pisa. The following year one was founded at Padua. In France, the earliest botanic garden was founded at Montpellier toward the end of the sixteenth century; and in Germany, that of Giessen was established in 1614; and in the Low Countries, that of Leyden dated from 1577. In England the Royal Garden at Hampton Court was founded by Queen Elizabeth, and supported by Charles II. and George III. Those which followed and still remain were: Oxford, founded in 1632; Chelsea, in 1673; and Edinburgh, in 1680. The origin of Kew as a scientific institution was entirely due to the Hanoverian princes. During the reigns of George IV. and William IV. Kew was much neglected; but since that date, owing to the efforts of Lindley and Hooker, this state of things has been remedied. Plant distribution to all parts of the world is extensively carried out from the gardens, especially that of cinchona, caoutchouc, and Liberian coffee. The herbarium is the largest in the world. The example of Kew in the matter of museums and economic botany has been followed by Hamburg, Berlin, Ghent, Paris, Boston, and the English colonies. Recently the whole vegetable collections of the India Museum have been transferred to Kew. Mr. Dyer stated that one of the most striking features of the gardens was the enormous correspondence with the botanic establishments of the colonies.

An Interesting Botanical Fact has been discovered by M. Lemoine, of Nancy, who finds that the stigmas of double flowers are capable of fertilization by the pollen of single flowers, with the result of yielding seeds which in the majority of cases produce double flowers.

Setting Type by Telephone.

The London *Times* contains an article describing the system of telephonic reporting adopted by that journal, in order to have the latest and fullest report of the speeches made in the Houses of Parliament. Permission having been obtained from the Metropolitan Board of Works to lay down the necessary wires in the subway of the Embankment, a new connection between the House of Commons and the *Times* office was formed, and one of Edison's loud-speaking telephones placed at either end. The immediate result of this arrangement has been to bring the compositor at the machine into direct communication with the Parliamentary reporter at the House, and to enable the debates to be reported and printed from half to three-quarters of an hour later than had previously been possible. The notes made by the reporter can be read directly into the telephone receiver in a room adjoining the gallery either by the reporter himself when relieved or by another person employed for the purpose; and the compositor, at his machine in the office, sits with his ears in juxtaposition with the other terminal of the instrument. The plan which has been found the most efficacious for the purpose of shutting out distracting sounds of other kinds is to place the disk of the telephone above and behind the compositor, and then to arrange two tubes, each with two trumpet-shaped extremities, in such a manner that these extremities are applied at one end to the two sides of the telephone disk and at the other end to the two ears of the compositor. The compositor is also furnished with a speaking instrument, with a key for ringing a bell, and with a bell which is rung from the House, a simple code of bell signals, consisting of one, two, or three strokes, sufficing for the ordinary requirements of each message. The compositor announces by the bell that he is ready, receives a sentence, strikes the bell to indicate that he understands it, sets up the type with his machine, strikes the bell again for the reader to continue his dictation, and so on until the work is carried as far as time will allow. If there is any doubt or difficulty about the words, a bell signal will cause them to be repeated, or explanations can be sought and received by direct vocal communication. In this power, indeed, resides one of the chief advantages of the method, and one which ought to lead to greater accuracy than has ever previously been attainable. The names of people, places, etc., can be spelled out letter by letter if there is any doubt about them.

Ice Gorge at Newton, N. J.

An interesting ravine, in which natural ice remains throughout the summer, is attracting local interest at Newton, New Jersey. It lies at the foot of Blue Mountain, is several hundred yards long, from ten to thirty feet deep, with caves and clefts in the rocks, filled with ice. The shade at the gorge is described as very dense, the sun apparently never penetrating it. The bottom of the gorge is covered with ice, and the little caves and crevices are filled with it. The parapet of the mountain, like the Palisades of the Hudson, is very nearly perpendicular, and rises about 400 feet above the ravine, through which a current of cold air sweeps constantly. The thermometer, which registered in the nineties in Newton, marked 38° at the bottom of this gorge—too cold for one to remain there any length of time. A few feet from one end of the gorge a spring of the most delicious sparkling water bubbles up. It tastes slightly of iron, and is very satisfying to the thirst. The water in this spring stands at 34°. The owner of the farm on which the gorge is found, says that it is much resorted to for ice, so that by the middle of August but little remains except in the caves and deeper holes.

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On the Advantages of Moistening the Air in Cotton Mills.

Considering the immense expenditure of brains and money during the last forty years by inventors, machinists, and manufacturers, in perfecting machinery used in the several processes of cotton manufacturing, one might be led to suppose that a mill, equipped with modern machinery such as is turned out by the best makers, would always produce goods of uniform weight and quality. Experience, however, shows that at almost any time there may be found in such mills a variation of from one to five or more numbers in the yarn, and from one to three per cent in the weight of cloth, and sometimes the same or more in width, and a quality far from perfect, although the average weight may be at or near the standard by taking a month's work together. Carding and spinning overseers regularly weigh roving and yarn several times a day, and alter gears if need be; yet with all this care and watchfulness they are not able to prevent the variations noted, although there has been no change either in cotton or in the general operations of the machinery.

In the light of present knowledge it is unreasonable for manufacturers to expect or require machine builders to make machinery that will produce uniform and exact results at all times, so long as no means are taken to produce a uniformity of atmospheric condition in which to operate the machinery. This has reference to variations of climate, and to electricity and dryness. Frictional electricity is generated by the motion of wind, belts, pulleys, fliers, bands, cylinders, beaters, etc.; also by the friction of rolls, bearings, etc. Its effects upon the cotton fiber are to cause it to cling to beaters, cylinders, and cylinder aprons, and to puff up the sliver, so that when it passes through the evener trumpet it delivers less actual fiber than intended, and less than it would if there was an absence of electricity, thus not only making variable sized yarn and cloth (as the electricity varies), but causing the work to run badly in the subsequent operations, which are set and calculated for a specific size of roving or sliver. In doubling and drawing there is a constant loss and damage to the sliver occasioned by electricity, which causes the fibers to stand out and catch on to and lap round the rolls. The electrical condition of the air varies much, and we have so little knowledge about it, and so few means of measuring it, that it is almost impossible to tell when and how much to alter machinery to correct its effects. Some means are needed in every department of a mill to absorb or destroy this disturbing element. Now it would seem that a remedy exists in moistening the air, thereby rendering it capable of conducting away the electricity as fast as it is produced.

A short time since, a well known and skillful American manufacturer had new cards of English make, which, when started, would take in cotton well enough, but the combs would not take it off the doffers until he had pails of water set all around the cards, and had watered the surroundings. The trouble was too much electricity, and carders often have similar experience with common cards, especially in dry and windy weather. We must always remember that dry air is a poor conductor of electricity. On the other hand, too dry air in some respects affects the running of the work in a cotton mill in much the same way as electricity, especially as regards the puffing-up of the sliver. Dry air absorbs the moisture from oil placed on bearings, thus depriving it of an important element of lubrication. Every band that drives a spindle ought to be, and is supposed to be, put on with just the amount of tension needed to run it properly. If the air at the time is dry, and changes to damp, then the band will be too tight, requiring more power to drive it, and more oil to lubricate it; while, on the other hand, if the air were damp and changed to dry, the band would become loose, and would not drive spindle to speed, and hence would make slack-twisted, poor yarn. It is well known that carding and spinning as well as weaving runs better in damp air; moisture gives elasticity to yarn. In weaving, warp threads are sized or starched to prevent their being roughed up by the action of the reed and harness, but the reed and harness will rough up and rub off much fiber and starch unless the air is moist enough to keep them in place. The sudden blows of the lathe in driving in the filling strains the yarn severely; so, unless there is some elasticity in the yarn, it is very liable to break, and of course causes imperfect work and loss of production. It is a common practice among weavers to moisten the yarn by placing a wetted cloth over the warp beam, especially if the warp be hard-sized. Most manufacturers now acknowledge the need of regular moisture, and some vainly try to obtain it in weaving rooms by blowing off raw steam, which usually gives much heat, but little water to dampen the air with.

In our climate, when it is dry weather, the air contains one or two grains of moisture to the cubic foot of air, and when damp, from five to twelve grains of water to the cubic foot of air, each depending upon the temperature. It is not claimed that a proper regular humidity will remedy the defects of machinery, but it is claimed that it will absorb electricity, or destroy its power to injure the proper manipulation of cotton, as well as give the most desirable condition in which to produce the best goods at the chapest cost.—*The Universal Engineer.*

Crystallized Prussian Blue.

To the various forms of Prnssian blue already known, such as soluble, insoluble, etc., we may now add a crystalline form. Prof. Gintl, in Prague, says that when freshly precipitated Prussian blue is treated with a slight excess of concentrated hydrochloric acid and gently warmed, it will dissolve. A larger excess of acid will dissolve it cold. The resulting solution has a faint yellow color, and when diluted with water the blue pigment again separates. If the solution be allowed to evaporate spontaneously at ordinary temperature, or is slowly diluted by the absorption of moisture from the atmosphere, the Prussian blue will separate as a crystalline sediment, which possesses a magnificent copper luster in reflected light, and hence a glass surface covered with a thin layer of this sediment looks like a copper mirror. When magnified somewhat this sediment is seen to consist of individual crystals, which have an intense blue color in transmitted light, but seen in reflected light glisten with a fine copper red.

In every position the crystals present quadratic faces to the observer, and being perfectly indifferent to polarized light, we must conclude that they belong to the regular, or isometric system, although the crystals were too small to be measured. Gintl did not obtain crystals large enough to permit of an accurate determination of the crystalline form, hardness, and specific gravity, but, if the experiment were carried out on a larger scale, and by conducting the evaporation or dilution very slowly, probably larger crystals will be obtained.

It is also of interest to know that what is called Turnbull's blue, formed by precipitating a ferrous solution with ferridcyanide of potassium, reacts in the same manner when treated with hydrochloric acid, and similar crystals separate. This fact favors the theory previously advanced that Prussian blue and Turnbull's blue are perfectly identical compounds. If a solution of oxide of iron containing an excess of hydrochloric acid be mixed with a solution of ferrocyanide of potassium, also containing hydrochloric acid, no precipitate is formed until diluted. With ferrous oxide and ferridcyanide, both containing hydrochloric acid, a pale yellow solution also results. In this solution sulphocyanides produce a red color, showing that the iron has been oxidized at the expense of the ferridcyanide, and then it unites with the ferrocyanide formed. This favors the identity of Turnbull's blue and Prussian blue.

What Constitutes a Conspiracy?

The preliminary contest in the St. Louis courts in the conspiracy suits of the Vulcan Steel Works against their workmen has been decided in favor of the company. The case is a somewhat peculiar one. James Tighe, Dennis Griffin, Michael Dimon, Martin Hanifin, Bart Fenton, Patrick Reiley, and Martin Hooley were employes in the converting department of the Vulcan Works. On the evening of the 5th of last April, when two heats of iron were partially melted, the cupola ladle filled with molten metal and the pits covered with cooling ingots, these men are charged with conspiring together and suddenly going out upon a strike for higher wages. This placed the Vulcan superintendents in a predicament, and they allege that, were it not for the timely arrival of a sufficient force of men at the works just at the proper time, the metal would have become hardened in the receptacles, causing the works to lie idle and putting them to a great deal of expense in placing them in working condition again. With the assistance of the new workmen they succeeded in escaping actual loss. The arrest of the parties named followed for conspiracy. Their attorney moved to quash the proceedings on the ground that they had committed no offense under the common law. The acting State attorney claimed that it was both a statutory and common law offense. The case was finally argued before Judge Cady, who delivered, at the session of the Court of Criminal Correction, the appended decision: "The statement contained in the information filed in this case, if true, constitutes, in my opinion, a clear case of conspiracy. It is doubtless true that there is no crime in the solitary fact that the several defendants agreed or conspired together that unless higher wages were paid they would cease work, but it is equally clear that for these defendants to confederate, conspire, and agree together to stop work under the circumstances and for the purposes alleged in the information, is an offense. It is true that the mere failure or a refusal to perform a civil contract is not of itself a crime. But the circumstances alleged in connection with the refusal of these defendants and others certainly constitute an offense. I am, therefore, of the opinion that the motion should be overruled and the defendants put upon their trial."—*Coal Trade Journal.*

Labor-Saving Machinery.

The *Shoe and Leather Reporter* thus sums up the labor-saving appliances which have been introduced into the boot and shoe manufacture within a few years:

To enter into a detailed description, remarks the editor, of these labor-saving devices would be an almost endless task, but a general idea can be gained from the following: Among the latest inventions is the hydraulic shoe press, with which one operator can sole 700 pairs of shoes per day. Next comes the beating-out machine, which is a most necessary adjunct to a large shoe factory. Then come several designs in power machines for trimming and planing the edges of soles of shoes, each doing the work of three men, and better than by hand. Next comes the sewing-welt, or turn machine, making a shoe as pliable and comfortable as one hand sewed, and it is hard to detect any difference, one machine being capable of making 120 pairs per day. Again, there is produced a lasting machine, whose work is simply perfect and wonderful. Then we have a new welt shoe machine, or aid to hand sewing, which pricks the holes and trims the sole, ready for the workman to simply put in the stitches, making the boot or shoe a hand sewed shoe in every essential particular. Then the numerous wax and dry thread sewing machines come in, adopted for every variety of work, from the finest French kid or velvet embroidered slipper to the closing up of the seams of the heaviest stoga boot or brogan. Again, we have a patent vamp folding machine, which neatly and rapidly turns the edge of the vamp, leaving a neat and finished appearance, instead of a raw edge; heel-scouring and sand-papering machines are made in every variety; stamping machines for monograms on the soles, heel trimmers, and an endless variety of small but useful machines; peg cutting and nail rasping machines, that will clean the pegs and nails out of a shoe from heel to toe, from a child's shoe to a heavy boot, leaving the inside perfectly smooth, which do not disturb the crimp or injure the upper in the least.

Then we have the boot and shoe crimping machine, two entirely separate inventions, the boot crimper being capable of perfectly crimping 12 to 16 cases of boots daily, and better than can be crimped by hand, and the shoe crimper that can finish in a perfect manner over 400 pairs per hour. In leather machinery we have glassing, stoning, pebbling, and polishing jacks, tanning and stuffing mills; hide unhairing machines that will do the work of 4 to 8 men, taking out the lime, doing away with the objectionable bating or drenching, and doing 800 sides daily with ease. Then we have the wonderful scouring or hide machine, that marvel of skill and ingenuity; union and belt knife splitting machines; bark mills, capable of grinding many cords of bark, wet or dry, daily; tan presses that will press perfectly one cord of bark per hour, and leave it so free from water that it can be immediately used for fuel; the wonderful leather measuring machine, for giving positive and instantaneous measurement of skins or leather. Then there is a new machine for softening leather, by which every fiber is loosened and softened without injury, leaving the leather strong, soft, and flexible, besides hundreds of other machines which are now being perfected. Our boot and shoe manufacturers are enterprising, and are always ready to adopt any new thing that has actual merit, and the shoe factories of to-day present a marked contrast with those of former years.

Yield of Butter from Cream.

I have, for some time past, kept accurate account of the quantity of cream put into the churn and the butter taken out, and I find that one quart of pure cream, weighing precisely two pounds, will make one pound of butter, as near as can be figured. This is the thick cream, which is taken in an adherent, leathery skin from a shallow pan in which the milk is three inches deep, and has been kept until it is sour, but not thick. From cream taken from a pail eighteen inches deep, and which stood four inches deep on the milk, but which was semi-fluid, three pounds of butter was given by four quarts of the cream. This cream was in good condition for churning, and needed no water to dilute it. It was distinctly sour, having been skimmed from milk set thirty-six hours, and was kept forty-eight hours before churning. The churning was sixteen quarts, which yielded twelve and one-half pounds; the temperature of the cream was sixty-two degrees, and the time of churning was eleven minutes. The cows were Jersey and Ayrshire. The more solid cream was all from Jersey milk, was in the same condition as the other as to sourness; twelve quarts were put into the churn, and eleven pounds fourteen ounces of butter came out; the cream was too thick to churn without considerable water being put in. The temperature of this churning was sixty-five degrees, and the time eight minutes. There is no doubt that sour cream will make better flavored and more solid butter, and more of it, than sweet cream; the butter will also keep longer in good condition. Sweet cream butter is excellent, and may be exquisite, if very well made, for immediate use, but it deteriorates very rapidly, while sour milk butter improves by keeping for several weeks, if well made and well kept. But neither the milk nor the cream should be permitted to turn to "clabber," as Mr. Bonner terms it.—*H. Stewart, in Country Gentleman.*

Rome to have an Exhibition.

It is proposed to have an International Exhibition in Rome in 1885-86, and a journal has been started to further the project. An effort is being made to secure for the Exhibition outside Porta Pia and Porta Salara, on the north side of Rome, embracing the Villa Albani, with its fine collection of sculpture and Italian garden; the Villa Borghese, with its pleasant walks and gallery; the Villa Ludovisi, adjoining the walls, with its casino, and the Aurora of Domenichino; the Villa Patrizi; the Villa Torlonia; the Villa Ada—lately the king's property, but since bought by Count Telfener—which reaches to the edge of the Anio; and the tract lying between these estates, from the furthest of which the land drops suddenly down to the Campagna, giving a splendid view of Soracte and the Sabine Hills.

A New Breed of Whales.

A whaling captain, lately returned from the Arctic seas, declares that a new breed of whales have made their appearance in those waters. They are supposed to have emigrated from the open sea at the pole. The skipper describes them as very much larger than the old whales, and very gentle and confiding. In former years when a whale was harpooned the rest of the herd threw up their flukes and made off. The new breed do not seem to mind in the least the capture of one of their number.—*N. Y. Evening Post.*

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Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Peck's Patent Drop Press. See adv., page 14.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 13.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 28.

For Separators, Farm & Vertical Engines, see adv. p. 28.

For Patent Shapers and Planers, see ills. adv. p. 28.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 29.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 29.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Silent Injector, Blower, and Exhauster. See adv. p. 45.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N.Y.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 45.

For Alcott's Improved Turbine, see adv. p. 45.

Air Compressors. Clayton Stm. Pump W'ks, Bk'lyn, N.Y.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 45.

Millstone Dressing Machine. See adv., page 45

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 413.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 45.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 45. Totten & Co., Pittsburg.

NEW BOOKS AND PUBLICATIONS.

DIGEST OF PATENTS ON CULTIVATORS.

Some time ago we had occasion to notice a valuable digest on seeding machines and implements, compiled by James T. Allen, of the Patent Office, Washington. Encouraged by the demaud for that work, the author proposes to issue in two volumes a digest of all the cultivators and attachments belonging to that kind of machine, which have been patented up to July 1 of the present year. They number over 5,700, and each invention will be illustrated, similar to the engravings in the *Official Gazette*. The full claims of each patent will be given, and when necessary for a better understanding the invention extracts from the specification will also be made. To manufacturers of agricultural implements and for patent solicitors and lawyers this new digest will be found very useful. Mr. Allen, whose address is Lock Box 699, Washington, D. C., would like to hear from persons who wish to subscribe for the work.

A DIGEST OF PATENT OFFICE DECISIONS, 1869-1879. By William Edgar Simonds. Washington, D. C.: W. H. & O. H. Morrison.

A digest, in classified and chronological order, of substantially all the reported decisions of the Commissioners of Patents to January, 1880. The cases omitted are mainly those the reading of which, in the authors' opinion, throws no light on any principle of law, mechanics, or practice. The digests appear to have been made with painstaking carefulness and sound judgment, and the volume cannot fail to be handy and serviceable to all having to do with patent law, whether inventors or attorneys.

ARCHÆOLOGICAL INSTITUTE OF AMERICA. First Annual Report of the Executive Committee, 1879-80. Cambridge: John Wilson & Son. 8vo, paper, pp. 26.

The Archæological Institute of America has been formed for the purpose of promoting and directing archæological investigation and research—by the sending out of expeditions for special investigation, by aiding the efforts of independent explorers, by publication of reports of the results of the expeditions which the Institute may undertake or promote, and by any other means which may from time to time appear desirable. Though but a year old the Institute has secured a large and influential membership, and has undertaken work which proves it worthy of a place in the front rank of American scientific societies. Its first year's contributions include a valuable essay by the Hon. Lewis H. Morgan, on the system of house building practiced by the Indians; Mr. J. T. Clarke's studies of the monuments and ruins along the Greek shores; and Mr. W. J. Stillman's investigations at Monte Leone in Italy. The Institute's work laid out for the present year includes an expedition to Colorado and New Mexico, to investigate the institutions and history of the Pueblo or village Indians of those regions.

THE CABINET MAKER AND UPHOLSTERER'S COMPANION. By J. Stokes. Philadelphia: Henry Carey Baird & Co. $1.25.

This is a fifth edition of Mr. Stokes's work, with valuable additions, covering the treatment, finishing, restoration, and improvement of wood surfaces. The book is well indexed and has a full table of contents.

SEWAGE DISPOSAL. By Henry Robinson. London and New York: E. & F. N. Spon. $1.50.

Reviews briefly the experience of British engineers and sanitarians in the disposal of water-carried sewage, no attention being given to any other methods of dealing with the waste matter of towns. Where suitable land is available Mr. Robinson advises irrigation, otherwise he would employ chemical treatment; but he does not encourage any extravagant expectations of profit from either method.

LETTS' POPULAR ATLAS. IN MONTHLY PARTS. London: Letts, Son & Co.

The first part of this promising series contains a double sheet showing the world on Mercator's projection, and a map of the British Isles. The maps are carefully drawn, clearly engraved, and well printed; size 17 inches by 14 inches. The price, seven pence a part of three maps, is very low for work so well executed. Ocean depths are shown by graded shades of blue; ocean currents by distinctive white and blue lines; ocean cables and main lines of land telegraph, by red lines. The plan includes special geological and railway maps. The first year's issue will cover the principal divisions of the globe; and subsequent parts will supply maps more in detail until the atlas is made complete. On special maps, roads, lighthouses, and other useful details will be given.

THE METRIC SYSTEM AND INTERCHANGE OF WEIGHTS AND MEASURES. By D. Beach, Jr., and E. A. Gibbens. New York: G. P. Putnam's Sons. 75 cents.

Apparently designed for a school book, to familiarize boys and girls with the names and comparative values of metric standards. The book is neatly made and seems likely to be useful.

THE AMERICAN BICYCLE. By Charles E. Pratt. Boston: Issued by the Pope M'f'g Company, 87 Sumner street.

A second edition of Mr. Pratt's manual for "the Observer, the Learner, and the Expert" in the use of the "wheel," to which the author has added an appendix for 1880. The new matter reviews the recent progress of bicycling at home and abroad, improvements in the manufacture of the wheel, recent races, the rules of American bicycle clubs, and offers forty-five new excursion routes, with stations and distances.

MEMOIRS OF THE SCIENCE DEPARTMENT, UNIVERSITY OF TOKIO, JAPAN, VOL. II. On Mining and Mines in Japan. By C. Netto, M.E., Professor of Mining and Metallurgy. Tokio, Japan: Published by the University.

In the order of their importance the minerals of Japan are coal, copper, silver, gold, iron, kaolin, petroleum, sulphur, lead, antimony, tin, cobalt, quicksilver, marble, jasper, agate, amber, graphite. The yield in 1877 was nearly eight million cwt. of coal; 75,423 cwt. of copper; 96,213 cwt. pig iron; 354,392 oz. silver, and 11,281 oz. gold. The production of antimony is increasing. The yield of lead, tin, copper, quicksilver and petroleum, is not sufficient for home consumption.

THE MOULDER'S AND FOUNDER'S POCKET GUIDE. By Fred. Overman, M.E., with supplement by A. A. Fesquet. Illustrated. Philadelphia: Henry Carey Baird & Co. 12mo, cioth, pp. 342. 1880.

A new edition of the late Frederick Overman's successful treatise on moulding and founding, the construction of melting furnaces, the composition of alloys, etc., to which Mr. Fesquet has added nearly a hundred pages on statuary and ornamental moulding, ordnance, malleable iron castings, and other matters of importance to moulders and founders; also a careful index giving eight or nine hundred references.

CATALOGUE OF BOOKS AND PAPERS RELATING TO ELECTRICITY, MAGNETISM, THE ELECTRIC TELEGRAPH, ETC., INCLUDING THE RONALDS LIBRARY. Compiled by Sir Francis Ronalds, F.R.S., and edited by Alfred J. Frost. London and New York: E. & F. N. Spon. 1880. 8vo, paper, pp. 564.

As early as 1816 Sir Francis Ronalds demonstrated by actual experiment the possibility of an electric telegraph, and showed that frictional electricity could be practically used for conveying messages over long distances. It was his misfortune, however, that in this particular his views and experimental demonstrations were a quarter of a century in advance of those of his scientific and official countrymen. After thoroughly proving the practicability of his scheme he submitted his plan to the First Lord of the British Admiralty, Lord Melville. After some delay he received from Mr. Barrow (afterwards Sir John Barrow) Secretary of the Admiralty, a curt note informing him "that telegraphs of any kind are now wholly unnecessary; and that no other than the one now in use will be adopted." This note was dated August 5, 1816, at which time the government was supporting a semaphore telegraph between London and Portsmouth, costing $10,000 a year, and usable only five or six hours a day in clear weather. For many years Sir Francis Ronalds devoted much time and money to the collection of a library of works relating to electricity, magnetism, and the telegraph, and the compilation of a catalogue of all such publications. After his death the collection was presented to the English Society of Telegraphic Engineers, and the catalogue, containing over 13,000 entries, has now been printed by the society. Its value to all specialists in this department of science goes without saying.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. J. B. writes: I am an architectural designer, and finish all my drawings, shaded elevations, etc, only in pencil. The penciling, however, rubs off too easy and dirties and spoils the drawing very badly. I should feel pleased to know of some liquid to pour over it and thus prevent the rubbing off of the penciling without spoiling the drawings, which are stretched on drawing board. A. A very thin aqueous solution of gum arabic is sometimes serviceable. Thin collodion (plain) does very well; or white of egg dissolved in dilute ammonia water by agitation with broken glass.

(2) J. B. G. writes: I would like to know what is the best material to use for gluing two pieces of wood together that will stand boiling water without injury. A. Try a solution of gum caoutchouc in bisulphide of carbon. Before using add to it about one per cent of chloride of sulphur (dry). The solution should have about the consistence of molasses. Give the cement plenty of time to harden in the joint.

(3) W. H. D. asks: What can I clean copper coins with and keep them bright? A. Remove grease by dipping in strong hot potash lye, then clean with cyanide of potassium solution (aqueous); or dip bright in nitric acid and rinse immediately in running water. To keep them bright, oil them, or coat with a thin pale alcoholic solution of pale shellac.

(4) C. A. H. asks what the dry paper is, or what it is saturated with, which gas men use for testing the gas for sulph-hydrogen, or impurities. A. Saturate unsized paper with a strong aqueous solution of acetate of lead, and dry. When moistened and exposed to gas containing sulphureted hydrogen it is blackened.

(5) C. W. A. says: My house is connected with water main by 800 feet of 1, 1¼, and 1½ inch iron pipe. The main is of wood wound with strap iron, and extends through the streets of the town. Now, I am going to put up lightning rods, and I want to know if it will give sufficient ground if I connect with the water pipe? What kind of rod, points, and fastening will be best? Please give me the method of destroying stumps by means of crude petroleum. A. The 800 feet of iron pipe will make a fair ground connection. Use several separate rods composed of one-quarter inch copper wire, one to each chimney and to each gable point. Attach the rod directly to house by staples; no insulators. Let each rod be in one piece; but if jointed see that the joints are well soldered. Carefully solder the terminals of the rods to the water pipe. Point the rods with a file. The important thing is to have several rods—the more the better—each rod thoroughly connected with the ground conductor, which in your case is the iron water pipe. As to stumps, bore deep with an auger, fill the hole with petroleum; repeat till the wood is well saturated with oil; then set fire.

(6) W. R. S. writes: Please inform me of some simple and efficient way to detect the presence of electricity passing from one body to another. A. For merely detecting a slight current there is nothing simpler than a bell telephone. If a current passes it will be readily detected when the connections are broken or established. If you desire to measure the current a galvanometer will be required.

(7) J. S. C. asks: 1. How can I make a good cheap foot walk? Would a walk made of lime and gravel last any length of time? If so, how is the right way to mix and lay it? A. See concrete floors and concrete walks in SUPPLEMENTS, Nos. 33 and 36. 2. Is a battery used with the telephone described in SUPPLEMENT, No. 142? A. No, unless a transmitter is used. 3. Can a battery be made of copper and zinc immersed in blue vitriol and water that will be strong enough to plate and electrotype with? A. Yes. See batteries in SUPPLEMENTS, No. 157, 158, 159.

(8) E. M. asks: Please tell how to test a steam boiler correctly. How many pounds water pressure will it need to safely carry 70 lb. steam pressure? A. Use a forcing pump. The government rule requires the test to be 50 per cent greater than the pressure of steam to be carried. For 70 lb. steam test, pressure 105 lb.

(9) F. F. asks: Please inform me in your next paper which of the different shafts in a factory is called the main shaft? A. The shaft, which first receives the power from the engine or water wheel, and from which the power is distributed to the various other shafts of the factory.

(10) T. D. writes: I have just completed a catamaran or double hulled sail boat, the plans for which I took from your SUPPLEMENT, No. 105. It has proved a great success, being very speedy and safe, and has in smooth water attained the speed of over 17 miles an hour.

(11) J. G. X. writes: In making a taper tap of say one sixteenth inch taper to the inch, I claim that after turning the taper you let the poppet head stand in the same position, and placing your thread gauge against the tap, set the lathe tool by the taper. The other party claims that after the tap is turned taper, you push back the poppet head to its true center, then set the tool with your thread gauge, bring the poppet to the taper again, and cut the thread. This I claim will not bring the thread square with the tap. Which is right? A. You are wrong. The pitch of the thread is taken on the center of the tap and not of the surface.

(12) L. W. asks: 1. What kind of a motor would be the best to run a fan 12 inches long, 8 inches through, shaft pulley 1 inch, with about 200 to 300 revolutions per minute, running for about 6 hours without attendance? A. A caloric engine, if you have neither steam nor water power.

(13) E. H. asks for a formula for making that paste or sticky substance for catching birds, something which will work as well in winter as in summer. I think it is called birdlime; if not, what is bird lime? A. Boil the middle bark of the holly, gathered in June or July, for six or eight hours in water, until it becomes tender; then drain off the water and place it in a pot under ground, in layers with fern, and surround it with stones. Leave it to ferment for two or three weeks, until it forms a sort of mucilage. This is pounded in a mortar into a mass and well rubbed between the hands in running water until all the refuse is worked out; then place it in an earthen vessel and leave it for four or five days to ferment and purify. This is an old fashioned receipt. Birdlime is also made from mistletoe berries and the bark of the wafering tree.

(14) F. C. S. writes: I have an old house which has not been painted in twenty years. Can you tell me of a sizing or something to put on before I paint with lead and oil, to fill up with and which will not scale? A. Sizing is not used. In painting old work the painter first cleans it with the brush and knife, stopping out the

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knots with red lead or shellac, filling cracks and holes with putty, and bringing forward new patches and decayed parts with a coat of priming (white lead thinned with about 3 parts of turpentine and one of oil with a small quantity of drier). The first coat (priming) is then applied expeditiously. It consists of white lead mixed with turpentine only. Then the finishing coats, thinned largely with oil, are applied.

(15) F. L. C. writes: I want a coloring matter, black, to mix with oils for use on leather. It must be either a liquid or something that will dissolve readily and thoroughly and leave no sediment. Lamp black I have found open to the last objection, besides not being a strong black. Cheapness desirable, and it must be of negative property that will not injure leather. A. Try soluble nigrosine dissolved in warm glycerine.

(16) C. R. J. asks (1) whether there is any kind of ink, and what it is, if any, that can be used with equal success with the copying pad shown on page 325, Vol. 41, of SCIENTIFIC AMERICAN, that will not fade as does the aniline violet. This seems to be the color used most, as the most copies can be taken with it according to present experience. Is there a way to render this color more durable? If so, how can it be done? A. The higher grades of soluble coal tar blues are more permanent. The fading cannot be avoided. 2. Who was the inventor of the process? A. The credit of the invention is claimed by several people. It probably belongs to a Viennese chemist.

(17) E. M. G. asks where to get the metallic cadmium. Is it an expensive metal? A. Cadmium is quoted at $4 per lb. It can be obtained through any chemist.

(18) P. H. C. asks: What will remove the disagreeable smell arising from boots, shoes, etc., worn during the summer months? A. Try a strong solution of sulphate of iron—copperas—in water.

(19) C. L. S. writes: In one of your last issues I see a receipt for making a perfectly insoluble glue. Can you give me the proportions of tannic acid, glue, and water? A. The glue will require for its precipitation about an equal quantity (wt.) of tannic acid, water enough to dissolve the glue.

(20) H. asks: 1. How can a hemlock sole leather tan shoe bottom be changed to an oak tan (which gives the bottom a white appearance)? A. The difference is due chiefly to the coloring matter of the former. Try coating with a paste of chloride of lime and water, and after washing with a little hyposulphite of soda solution, finally rinse with water, dry and roll. 2. What is the article used in shoe factories known as French yellow? Is it turmeric? A. Extract of French berries, fustic, quercitron, and turmeric are used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. S. S.—Clay slate, contains arsenical pyrites—mispickle.—B. K. D.—The glimmering particles in the gravel are mica fragments of quartz and pyrites.—R. A. L.—We have not seen the samples.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 22, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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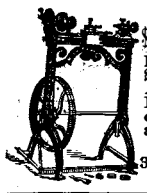

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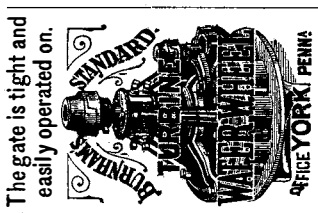
For further information, apply to the undersigned, to whom all proposals and communications shall be addressed.

J. P. NEWELL, City Clerk,
Joplin, Missouri.



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As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of all such locks and keys for the purposes of the mails, the Postmaster General prescribes no models or samples for bidders, but relies for a selection on the mechanical skill and ingenuity which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

Proposals, with samples, will also be received at the same time, for Safety Chains for Mail Keys.

Specifications of conditions and requirements as to proposals, samples, kinds and quantities, contracts, etc., as well as forms of proposal, will be furnished on application, by letter, to the Second Assistant Postmaster General. No proposal will be considered, unless it shall have been submitted in accordance with such specifications and forms.

The Contracts which may be made will be in conformity to the specifications and the accepted proposals.

D. M. KEY,
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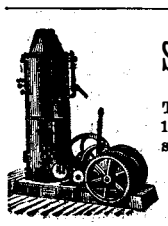

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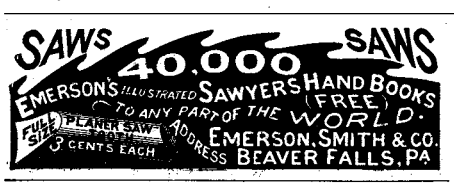

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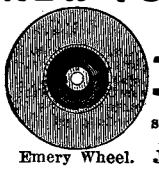

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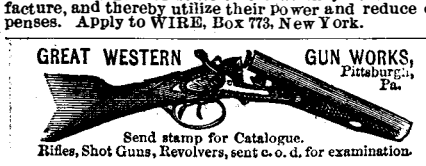

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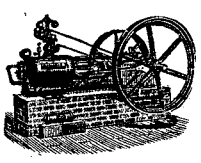

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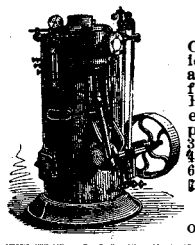

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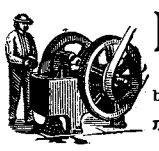

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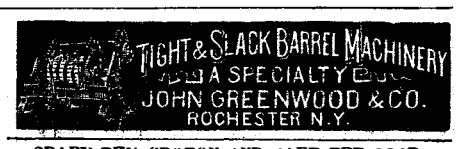

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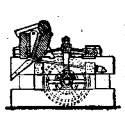

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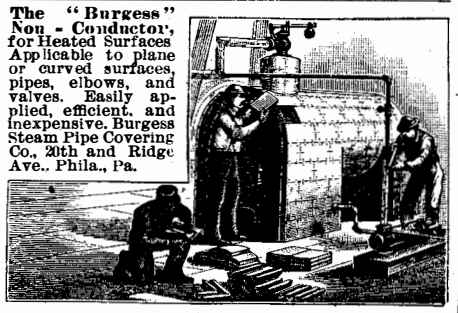

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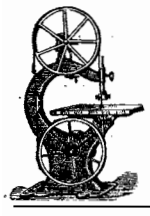

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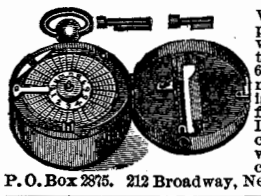

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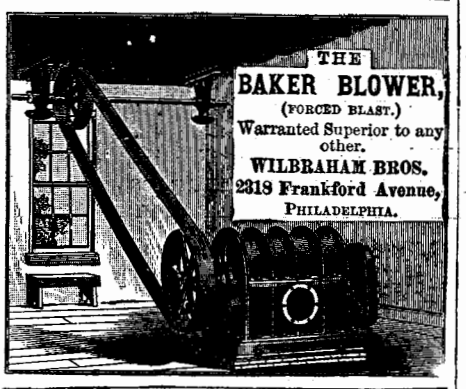

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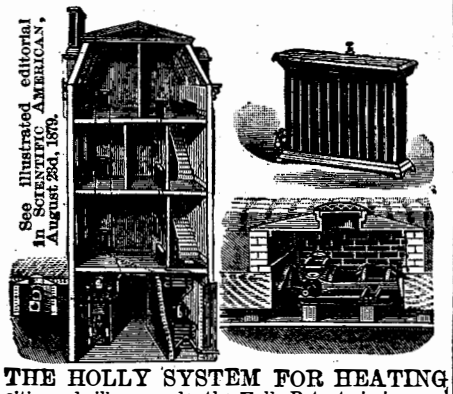

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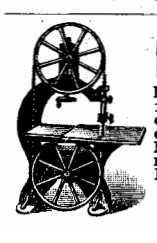

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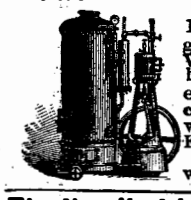

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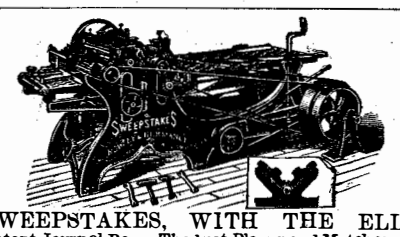

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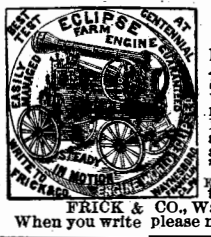

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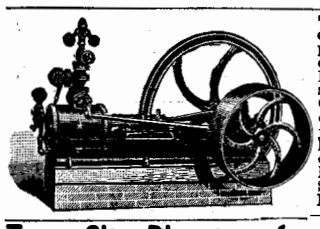

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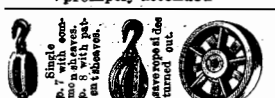
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